

CTEC 2431 – Applied Instrumental Analysis II Course Syllabus, Spring 2010

Course: CTEC 2431 – Applied Instrumental Analysis II
Instructor: Dr. Judy Chu
Office: K-206
Phone: 979-230-3435
E-mail: judy.chu@brazosport.edu
Office Hours: Tuesday 3-5 p.m. and by appointment

Required Books and Supplies:

1. Kenkel, John, Analytical Chemistry for Technicians, 3rd Edition, Published by Lewis Publishers, 2003.
2. Organic Chemistry Lab Notebook, Published by Signature Labs.
3. Scientific Calculator.
4. Safety Goggles, must meet ANSI Z87.1-1989 certification.

Course Requirements

1. Bring textbook and calculator to class.
2. Come to class prepared.
3. If you miss 2 or more labs, you will be dropped from the class.

Course Goals:

Studies of advanced topics in instrumental analysis. Topics include infrared spectrometry, UV/Vis spectrophotometry, atomic adsorption, inductively coupled plasma, nuclear magnetic resonance, gas chromatography/mass spectroscopy, liquid chromatography, and polymers.

Prerequisite: CTEC 1441 (3, 3)

Grades

Final Grades will be determined according to the following system:

Total points possible: 100

90-100 = A

80-89 = B

70-79 = C

60-69 = D

0-59 = F

Exams 40%

Lab 40%

Final 15%

Attendance 5%

Examinations

The examinations will last approximately one hour during class, with the exception of the final, which will last two hours. The exact date of each quiz will be announced in class closer to the actual date. Students are allowed to bring a one-page, hand written note card containing equations, etc., to the exams. There will be no make-up quizzes. The final exam grade will replace any missed quiz grade. The final will be **comprehensive**.

Homework Assignments:

- A maximum homework grade of 10 points will be awarded to homework assignments handed in on time. **All work must be shown to obtain full credit for the homework assignments.**
- Homework assignments are due prior to the start of each exam. For example, Quiz 1 covers chapters 7 and 8; therefore, homework assignments for these chapters are due immediately before the start of Quiz 1. The 10 points will be added to the corresponding quiz grade as bonus points.
- Homework assignments for each chapter are listed in the following page.

Class Attendance Policy

- If you are unable to complete this course, you must withdraw by Friday, March 27, 2010. Withdrawal from a course is a formal procedure, which you must initiate; I cannot do it for you. If you stop attending class and do not withdraw, you will receive a performance grade, usually an "F". If you think you must withdraw from this course, please talk with me about it first.
- Being late for class is an extreme annoyance to the entire class. Be on time!
- Leaving class early is also an extreme annoyance to the entire class.

Academic Code of Conduct

Anyone who cheats on an exam will get a zero on that exam. Students are advised to read the Standards of Student Conduct in the Student Guide and Calendar for a complete description of college policies, rules and regulations in this and other areas.

Study Tips

Class attendance and participation will be important to your success. Come to class prepared. This means that you should spend at least six hours per week outside of class studying and doing homework assignments. Space out your studies evenly. Your retention and understanding of the material will be enhanced if you follow these simple rules.

CTEC 2431 – Spring 2010 – Tentative Schedule*

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WEEK	LECTURE TT 5:35 – 6:50 PM	LAB Tuesday 7-9:50 PM	
Jan. 11	Introduction to Organic Chemistry	Safety and check-in. See lab syllabus for experiments	
Jan. 18	Chapter 7 – Introduction to Spectrochemical Methods		
Jan. 25	Chapter 8.1-8.5 – UV-Vis Spectrophotometry		
Feb. 1	Quiz 1 Chapter 8.6-8.11 – FTIR Spectrometry		
Feb. 8	Chapter 8.6-8.11 – FTIR Spectrometry		
Feb. 15	Chapter 9 – Atomic Spectroscopy		
Feb. 22	Chapter 9 – Atomic Spectroscopy Quiz 2 (FTIR and AA)		
Mar. 1	Chapter 10 – Other Spectroscopic Methods – Nuclear Magnetic Resonance Spectroscopy		
Mar. 8	Chapter 10 – Other Spectroscopic Methods – Mass Spectrometry		
Mar. 15	Spring Break	No Lab	
Mar. 22	Chapter 13 – High Performance Liquid Chromatography		
Mar. 29	HPLC lab – extended lab (5:30 – 9:50) Quiz 3 – NMR, MS and HPLC		
Apr. 5	Chapter 14 – Electroanalytical Methods Chapter 15 – Physical Testing Methods		
Apr. 12	Chapter 15 – Physical Testing Methods Polymer Chemistry		
Apr. 19	Polymer Chemistry Quiz 4	Clean-up	
Apr. 26	Review for Final Final – Thursday, April 29, 5-7 PM		↓

*This schedule is subject to change.

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Homework Assignments: A maximum homework grade of 10 points will be assigned to completed homework assignments handed in on time (prior to the start of the exam). These points will be added to the corresponding exam grade as bonus points.

For Quiz 1: Due before Quiz 1

Organic Exercise Sets 1, 2, 3, and 4 (handout)
7 (3, 7, 18, 19, 20, 21, 22, 23, 25, 43, 51, 60, 63, 65))
8 (1, 3, 8, 18, 20, 26, 28, 31)

For Quiz 2: Due before Quiz 2

8 (50, 52, 53, 56, 57, 58, 59, 63, 64, 66, 69, 75, 76)
9 (3, 7, 9, 10, 12, 17, 20, 23, 49, 50)

For Quiz 3: Due before Quiz 3

10 (2, 3, 5, 6, 7, 9, 12, 13, 15, 17, 21, 26, 29, 30, 31, 32, 33, 34, 35, 41, 43, 44, 45)
13 (1, 7, 8, 13, 19, 22, 36, 45, 49, 56, 60, 61)

For Quiz 4: Due before Quiz 4

14 (2, 3, 7, 8, 9, 12, 19, 26, 59)
15 (3, 8, 9, 10, 13, 15, 17, 19, 22, 26, 29, 31, 33, 35, 39, 41, 42, 47, 50)
Polymer Chemistry Problem Set

CTEC 2431 Lab – Spring 2010

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Experiments for Applied Instrumental Analysis Lab

- 1) UV-Vis
 - a) Experiment 23: Determination of Nitrate in Water by UV Spectrophotometry. (Kenkel, page 234, and Handout)
 - b) Experiment 19: Colorimetric Analysis of Prepared and Real Water Samples for Iron. (Kenkel, page 197)
 - c) Colorimetric Determination of Aspirin. (Handout)
 - d) Analysis of Analgesic Tablet for Caffeine by UV Spectrophotometry (Handout)
- 2) FTIR
 - a) IR Tutor (Interactive tutorial on the computer)
 - b) Experiment 25: Qualitative Analysis by Infrared Spectrometry - Liquid Sampling. (Kenkel, page 235, and Handout)
 - c) Experiment 26: Qualitative Analysis by Infrared Spectrometry - Solid Sampling. (Handout)
 - d) Experiment 28: Measuring the Pathlength of Various IR Cells (Kenkel, page 237, and Handout)
- 3) AA
 - a) Experiment 34: The Determination of Sodium in Soda Pop by Atomic Absorption. (Kenkel, page 271, and Handout)
 - b) Experiment 32: The analysis of Snack Chips for Sodium by Atomic Absorption (Kenkel, page 270, and Handout)
- 4) Viscometry
 - a) Measuring the Viscosity of Polystyrene using a Capillary Viscometer (Handout)
- 5) HPLC
 - a) The Quantitative Determination of Methyl Paraben in a Prepared Sample by HPLC.
 - i) Determination of the Optimum Mobile Phase Composition
 - ii) Methyl Paraben Quantization
- 6) FTIR Analysis and Thickness Determination of Various Polymer Samples
- 7) TOC – to be announced.

Applied Instrumental Analysis II Lab

Safety:

1. Safety goggles must be worn at all times in the laboratory.
2. Know the locations of eyewashes, showers, fire extinguishers and exits.
3. Use common sense.
4. Bare feet are NOT allowed into the laboratory. Open sandals and shoes are discouraged.

Laboratory Housekeeping:

1. Arrange apparatus neatly and compactly. Keep all books except the laboratory manual and laboratory notebook off the laboratory workbench.
2. Do not throw paper or solid materials into the water troughs or sinks.
3. Keep all reagent bottles clean (especially acids and bases).
4. Keep the lab bench area clean. Pay particular attention to keeping the balances clean and in order. If you spill chemicals, clean them up immediately. Put caps back on reagent containers.
5. At the end of the laboratory period, clean off your workspace with a sponge or wet paper towel. Perform proper shutdown of the instruments. Check to see that the gas and water have been turned off. You are responsible for keeping the area neat. Repeated failure to do so may result in loss of credit.

CLEAN UP AND INSTRUMENT SHUTDOWN STARTS 10 MINUTES BEFORE THE OFFICIAL END OF THE CLASS PERIOD.

When the time is up, you are supposed to be out of the laboratory. Failure to properly budget your time is presumptive of poor planning and your grade may suffer.

Grading:

1. Come prepared to the lab. The introduction (objective, discussion), safety, material and apparatus, should be written in the Laboratory Notebook prior to the beginning of the experiment. The format for the lab notebook is described in detail in the handout (Report Format for CTEC 2431). This pre-lab write-up (30 points) must be checked and initialed by me prior to the start of each experiment.
2. Experimental data and observations must be recorded in the Laboratory Notebook. The data sheets and observations (20 points) must be completely filled out in ink and initialed by me before you leave the lab. When you make an error, cross it out with a single line. Do not use liquid paper or obliterate the error. For example: ~~error~~ error
3. After a lab is finished, write the date that you finished the lab on the lab sign-up sheet. This signifies that your lab report will be due one week from that date.
4. Analysis of the data, calculations, including any tables and graphs, and summaries and conclusions (50 points) are due one week after the conclusion of the experiment.
5. Carbon copies of the complete experimental write-up are due the week after you finish the experiment.
6. Grading will be based on completeness of the experiments and the submitted report write-up.

REPORT FORMAT for CTEC 2431

- I. Introduction
 - A. Objective
 - B. Discussion
 - I. Theory of operation performed (what happens in the analysis to obtain results).
 - II. Brief write-up of procedure.
 - III. Reactions if any.
 - IV. Method used to calculate or to obtain results.
- II. Safety precautions involved.
- III. Materials and Apparatus
 - A. Reagents used. Equipment used (glassware etc.) used.
 - B. Instrument (type - model number etc.) used.
- IV. Results
 - A. Raw Data and Observations

This is the data obtained in the procedure (weights, titrations, sample volumes, any data used to obtain results). The read out charts from the instrument determinations and graphs are attached to the reports. The data from them is shown here too, such as peak sizes, etc. No results here! Any deviation from the procedure should be included here.
 - B. Calculations and/or Results

All calculations, if any, are shown here.
Results are shown here.
- VI. Summary and Conclusion
 - A. Short summary of experiment. Results are included in the summary too!
 - B. Comments pertaining to: Was objective obtained? How did the experiment go? Any problems? Your evaluation of the experiment, etc.

Grading:

Objective	10 points
Discussion	10 points
Safety	5 points
Materials & Apparatus	5 points
Raw Data	20 points
Calculations & Results	30 points
Summary & Conclusion	20 points

Reports on experiments are due one week after they are finished. Each week that the report is turned in late, 5 points will be taken off the grade.

An Example Report:

Experiment

I. Introduction

A. Objective

To determine % ppm or what is in an unknown.

B. Discussion

1. Theory

In a chromatographic determination, the components are separated by their interaction between the mobile and the stationary phases as they move through the column. Temperature, carrier gas flow rate and the type of packing in the column affect the separations. (This is in your book as are all theories of the other methods. If it is a titration, tell what a titration is.)

2. Procedure

Short procedure. Do not put all the steps you do in order to get an instrument ready for the analysis.

3. Reactions

Reactions if any.

4. Calculation formulas

How results are arrived at, calculations etc.

II. Safety

III. Materials and Apparatus

IV. Results

A. Raw Data and Observations

Sample weights.

Area counts and calculations as in the internal standards method.

Milliliters of titrations.

Linear regression calculations if needed.

Anything that is used to get the results.

Dilutions.

Any deviations from the written procedure.

B. Calculations and Results

Calculations for results.

Titration calculations.

Results are shown here. Do not refer to charts, graphs or readouts. They are backup data only.

V. Summary and Conclusion

A. Summary

Short write up of what was done. **Results** are shown here too.

B. Conclusion

How did it go? Was objective obtained? Problems? Anything good or bad about the experiment.

Working With Your Lab Partner

Lab Partner's Name _____

Best way to contact (phone, email...) _____

To become a productive lab partner, develop and fine-tune the following skills and abilities:

1. **RESPONSIBILITY.** Before leaving the lab, make sure both you and your lab partner have completely filled out both your and your partner's data sheets. This is your insurance policy.
2. **LISTENING SKILLS.** You must be able to put your own thoughts aside and listen without interrupting or interpreting what your partner is saying. Try it - it's not easy.
3. **SELF-CONFIDENCE.** You must believe in yourself and in the worth of your contributions. Speak up!
4. **OPEN-MINDEDNESS.** Welcome change, and listen to the ideas others bring.
5. **CREATIVITY.** Try stretching yourself outside of your routines. Try a different method. It might work better than your current method.
6. **THOUGHT.** Keep your goal in sight. Instead of following the lab manual like a recipe, consider the instructions to be a guide. When you make an error, how can you adapt the manual's procedure to still reach your goal? Which type of balance will give you enough significant digits?
7. **RELIABILITY.** Do what you say you're going to do.
8. **OBJECTIVITY.** Assess ideas, thoughts, opinions from all sides, not just yours.
9. **OPTIMISM.** Look at problems as opportunities. Knocking over the beaker containing your product can lead to learning about purification techniques.
10. **COOPERATION.** You must be able to accept team decisions and work just as hard on other people's ideas as you do on your own.

Adapted from Ern, B. L. and Lawley, C. M. (1992). The office professional as a team player. Office Hours, 229, 1.