

## Chemistry 322 - Instrumental Analysis Fall 2009

### I. General Information

Instructor:

**Dr. Brian Lamp**

Office: MG3106  
Phone: 785-7251

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Schedule:

Lecture	MWF	8:30-9:20 AM	MG2007
Laboratory Section 01	Thur.	8:30-11:20AM	MG1030
Laboratory Section 02	Tue.	2:30-5:20PM	MG1030
Laboratory Section 03	Mon.	1:30-4:20PM	MG1030

Textbook:

“*Undergraduate Instrumental Analysis*”, Sixth Edition, James W. Robinson, Eileen M. Skelly Frame, and George M Frame II, Marcel Dekker, 2005.

Laboratory Manual:

No laboratory manual is required. Experiments will be posted on Dr. Lamp's CHEM 322 website. Supplemental handouts may also be given.

Laboratory Notebook:

A permanently bound laboratory notebook capable of creating duplicate pages *is required* of all students.

Other Materials:

All students will be required to purchase departmental approved *safety goggles* for use in the laboratory. It is also important that all students have a *hand-held scientific calculator* for use on homework problems, quizzes, and exams. It will be assumed that you have a calculator for all quizzes and exams. The instructor will not loan calculators to students who have none. Some photocopy costs may be necessary.

Office Hours:

Office hours will be posted on the schedule by Dr. Lamp's office door and on his website. If you are unable to meet during these hours when in need of help, please arrange a time IN ADVANCE.

Course Objectives:

- Provide background information on the principles of operation, strengths, limitations and applications of modern chemical instrumentation.
- Provide hands-on experience with instruments.
- Develop the skills needed to evaluate a problem and choose an appropriate method for chemical analysis.
- Continue to hone observation, data interpretation and decision-making skills.

Academic Integrity:

Students are expected to abide by the Truman State University Student Conduct Code and complete their coursework, including exams and laboratories using their original words and ideas and properly cite the words and ideas of others. Students caught committing an act of academic misconduct will be subject to the full range of penalties, including failing the course. In every case, the Dean of Student Affairs office and the Provost and Vice President for Academic Affairs will be notified.

### II. Lecture

Course Coverage:

The lecture portion of the course will cover the following topics in analytical chemistry. Readings from the text and problems will parallel the main topics.

- |   |                              |
|---|------------------------------|
| A. Basics of Instrumental Measurements    | E. Mass Spectrometry         |
| B. Electronics & chemical instrumentation | F. Interactions with “light” |
| C. Signals and Noise                      | G. Atomic Spectrometry       |
| D. Separations                            | H. Molecular Spectroscopy    |
|   | I. Electrochemistry          |

Exams:

Four exams worth a total of 400 points will be given. These exams will be given in the evening to allow more time for reflection on the exam material. Dates for these exams are:

<b>Wednesday, Sept. 23</b>	<b>~6:30 PM</b>	<b>Room TBA</b>
<b>Wednesday, Oct. 14</b>	<b>~6:30 PM</b>	<b>Room TBA</b>
<b>Wednesday, Nov. 11</b>	<b>~6:30 PM</b>	<b>Room TBA</b>
<b>Wednesday, Dec. 9</b>	<b>~6:30 PM</b>	<b>Room TBA</b>

A comprehensive final exam (the American Chemical Society Standardized Exam) will be given Friday, December 18 from 7:30-9:20 AM in MG2007. The final exam will be worth 200 points.

Assignments:

Assignments involving the reading, homework, or literature work will be given. These assignments will be graded so that the total contribution to the final grade is a maximum of 250 points.

- Homework has a *significant* impact on your success in the course, not only in terms of its contribution to the total points in the course, but also in terms of preparation for quizzes and exams. Adequate time and consideration should be given to these assignments.
- Not all assignments will be graded
- Late assignments will not be accepted. Due dates will be announced in advance and will be strictly enforced.
- Reading and homework assignments will be announced at the beginning of class. *The instructor assumes no responsibility for communicating the assignment again for those who are late or miss class.*
- *Failure to turn in homework assignments will have a bearing on the consideration of borderline grades at the end of the semester.*

Quizzes:

The instructor reserves the right to give lecture or laboratory pop quizzes. Quizzes are likely to result from poor lecture and laboratory preparation, unsafe lab practices, or poor course citizenship.

Lecture:

The lecture portion of the course will explore and elaborate upon topics presented in the reading. Since the lectures will most certainly contain additional information not present in the reading, attendance is critical. *As a result, lecture attendance will play a role in borderline grade assignments. **Class begins promptly at 8:30 AM! I reserve the right to lock the door at that time to prevent disruption by students who arrive late.***

Make-ups:

No make-up exams, quizzes, or labs will be given without prior approval. If you cannot attend a scheduled exam for a ***valid, instructor-approved reason***, notify Dr. Lamp IN ADVANCE and an arrangement will be made. No credit will be given for missed labs, exams or quizzes without prior instructor approval. Valid reasons include traveling with a University-sponsored organization, illness, or death in the family. If a sudden, unexpected event occurs that causes your absence, contact the Student Affairs Office and they will contact me. Also, please leave a voice or e-mail message for me and contact me immediately upon your return,

## II. Laboratory

Expts.: A variety of experiments will be performed during the semester. These experiments will be performed in small groups of 2 or 3 students. *Your lab time must be used efficiently in order to finish the experiments during their allotted time.* Before coming to lab you should familiarize yourself with the theory, techniques, safety precautions, and instrumentation for the experiment. It is essential to have your experimental procedure outlined thoroughly and data tables set up BEFORE coming to lab. The experiments to be performed during the semester will come from the list below.

1. Electronics Lab #1
2. Electronics Lab #2
3. UV-Vis Spectroscopy
4. Fluorimetry
5. Infrared Spectroscopy
6. Graphite Furnace AA and Flame Emission Spectrophotometry
7. Capillary Zone Electrophoresis
8. High Performance Liquid Chromatography
9. Gas Chromatography
10. Gas Chromatography-Mass Spectrometry
11. Electrochemistry: Voltammetry

Lab Grading: Lab performance has a major bearing on your overall course grade. The two areas listed below contribute to your lab grade.

- A. Lab Notebook: It is important that accurate and comprehensive records be kept when performing an analysis. Therefore, you will be required to keep a bound notebook containing procedural outlines, laboratory data, calculations, graphs, results, and error analysis. Five of the regularly scheduled experiments will be graded for a total of 150 possible points. The identity of the graded experiments **will not** be announced in advance. All other labs will be evaluated and used in determining borderline grades.

***Once an experiment is completed, you have one week (7 days) to turn in the carbon notebook copies or be subject to the penalty described below.***

***The instructor places a great deal of emphasis on answering lab questions, discussion of results, and data treatment. Be sure to address these items thoroughly in your notebook.***

Notebook Format: The format for your notebook for CHEM 322 is similar to that used in Quantitative Analysis. A procedural outline should be completed and data tables prepared prior to lab. The following format is required. Each section must be clearly labeled in your notebook!

- I. Title: Include your name (and lab partners), experiment title, and date.
- II. Statement of Purpose: Clearly and concisely describe the purpose of the experiment, including the general method that will be used and anticipated results. This should be *brief*, two or three sentences maximum. Use complete sentences.
- III. Background: Include pertinent information like balanced chemical reactions, hazard information and references to the source for the experimental procedure

- IV. Procedure: A concise summary of the procedure (and any modifications) in outline form. DO NOT copy verbatim from your lab manual, substantial penalties will result.
- V. Data: Raw numerical data, as well as any observations, instrument parameters, chemical information, etc. *This must be separate from the Procedure section. Computer filenames and identities must be recorded here as well.* If several spectra, etc. are collected for a given experiment, only one or two example spectra need be included in the notebook. A data table summarizing all data must be included for the complete data set.
- VI. Results and Data Treatment: Present an *organized* example of your calculations, with brief explanations provided when necessary. Include any plots and graphs and a table of summary data. Don't forget relevant statistical analysis and consideration of significant figures!
- VII. Discussion and Conclusions: This section must be typewritten and affixed to page(s) in your notebook. The Discussion and Conclusions section is weighed most heavily when grading. Include a discussion of the significance of your results in terms of meaning, accuracy, precision and error analysis. Include any insights you feel are important as well as appropriate references. For each experiment, consider the following issues in your discussion.
1. What are the primary limitations to quantitative application of this technique (sensitivity, linearity, detection limit).
  2. What other types of analytes would this technique be appropriate for?
  3. What is the estimated replacement cost for the instrument? Include the source for your estimate.
- VIII. Questions: Any questions presented in the experiment should be answered.
- Other reminders:
- Be Prepared! Come to lab with an understanding of the experiment and with the Title, Statement of Purpose, and Procedure sections of your notebook complete and the Data section ready to go.
  - Keep an updated Table of Contents for your notebook.
  - Use only permanent ink in your notebook, correct errors by drawing a single line through the incorrect entry and initial the correction.
  - The use of spreadsheets for data analysis and presentation is not only acceptable but also encouraged.
  - Whenever inserting a computer generated plot or spreadsheet, affix a copy to both the original and carbon copy page in your notebook. Also be sure to note the filename and location for the computer file.
  - Sign and date the lower right-hand corner of each page as it is used.
  - Include in the Data section the brand, name, serial number and settings of all instruments as well as lot numbers and suppliers of all chemicals.
- B. Formal Lab Report/ Lab Project. One hundred (100) of the points for the semester will be allocated to a formal lab report or lab-related project. Further details for this assignment will be provided early in the semester.

Late  
Hand-ins:

**A penalty of 20% per calendar day will be assessed for turning in notebooks later than the assigned date. After 5 days, a grade of zero will be awarded.**

#### IV. Grading

Grade point breakdown: Letter grades will be determined based on the percentage from the breakdown below.

<u>Grade Point Distribution</u>	
<u>Source</u>	<u>Total Points</u>
Exams	400 pts. maximum
Assignments/Quizzes	250 pts. maximum
Final Exam	200 pts. maximum
Lab Notebook	150 pts. maximum
Formal Report/Project	100 pts. maximum
Total points	1100 pts. maximum

Grading Scale: Awarding of final class grades will be based on the scale below. Percentages will be computed on the basis of total possible points for the semester.

<u>Grade</u>	<u>Percentage</u>
A	90.0-100
B	80.0-89.9
C	70.0-79.9
D	60.0-69.9
F	<60.0

*The instructor reserves the right to lower the grading scale, but it will never be raised. REMEMBER: You must earn a passing percentage from the laboratory in order to pass the class.*

**YOU MUST SUCCESSFULLY PASS THE LABORATORY  
IN ORDER TO PASS THE CLASS!**

#### V. Other Information

- Please trim the edges of any spiral notebook paper prior to submission. The instructor reserves the right to not accept assignments without this consideration.
- All assignments in lab and lecture *must be written legibly and in a well-organized fashion*. If an answer or work cannot easily be interpreted, no credit will be given.
- All mathematical work and assumptions used when solving a problem, whether on homework or exams, *must be shown in order to receive credit for the problem*. Please mark your answers clearly.
- Do not procrastinate!!! It will not be possible to complete and understand many of the homework assignments if work on them is delayed until the night before they are due. Your understanding of lecture material, and grades on homework and exams will be adversely affected by this approach. *It is strongly recommended that you work ahead on reading and homework and participate fully in classroom discussions and problem solving sessions.*
- Homework, exam keys, announcements and various other information can be found on Dr. Lamp's CHEM 322 web page at [www2.truman.edu/~blamp](http://www2.truman.edu/~blamp).
- The instructor expects the students in this course to conduct themselves in an ethical manner. Unethical practices such as cheating or plagiarism will be handled in accordance with university policy.

***I'm a great believer in luck, and I find the harder I work the more I have of it.***  
**Thomas Jefferson**