CHE 315: INSTRUMENTAL ANALYSIS

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Instrumental Analysis is an overview of the various hardware-based methods of chemical analysis. We will discuss the physical and chemical basis of these instruments and their components, and explore the instruments' strengths and limitations in solving analytical problems. In the laboratory portion of the course you will gain hands-on experience with many of these techniques. The number and sophistication of modern instrumental techniques are growing rapidly, and it is therefore impossible to examine all of the techniques in depth. We will cover only a selection of the most relevant techniques in varying levels of detail.

TEXTBOOK

The textbook for the course is *Principles of Instrumental Analysis* by D. A. Skoog, F. J. Holler, and S.R. Crouch, 6th edition, 2007, Saunders (ISBN-13: 978-0-495-01201-6; ISBN-10: 0-495-01201-7). You should regularly visit the publisher's web site (see link on course web page), as it has several important resources including spreadsheet examples, tutorials, simulations, and animations.

REQUIRED LAB NOTEBOOK

A carbonless lab notebook (National Brand 43-644 or similar) is required for the laboratory portion of the course. These notebooks are available from the Alamo and Barnes & Noble, and at numerous online sites.

PROBLEM SETS

Problems from the textbook and the course web site will be assigned throughout the semester. Each problem set is worth 5 points and will be **due <u>at the beginning of class</u> every Monday**. The problem sets are not graded; instead you will earn a completion grade that will vary from 1 to 5 points. The grade will depend on which of the following criteria are met:

1. The problem set must be turned in at the beginning of the period on the day it is due.
2. Substantial effort must be evident on all problems. **<u>Simply writing the answer from the back of the book is not acceptable.</u>** Show your work!
3. The work must be your own. Copied problem sets are easily spotted! Everyone with identical answers will receive a score of 0 for the problem set.
4. All questions must be answered completely.

Keys to the problem sets will be posted on the web page at 3 PM on the day that they are due. If you forget to work or to turn in a problem set, you may turn it in to me before 3 PM for half credit. Problem sets will not be accepted after 3 PM on the day they are due.

Note that there are 50 points allotted for the problem sets. Since there will be 12-13 problem sets (60-65 points possible), you may earn extra credit if you turn in all of the problem sets.

Students turning in 75% or more of the assigned problem sets can have their lowest hour exam score replaced by the average of the other two exams (limited to a maximum of a 35-point improvement—see the Grading section below for details). There will be about 12-13 problem sets, so you can only miss 3 assignments! Problem set scores of 0 will count as a missed assignment.

ATTENDANCE

You are expected to attend all class meetings. Attendance will be the deciding factor for borderline grades.

ACADEMIC HONESTY

While you are encouraged to work together on the data for your lab reports and homework, all work that you turn in must be your own. Substantially similar lab reports and homework will be returned ungraded. Problem cases will be dealt with according to University policy.

EXAM POLICY

- The following items are prohibited during exams: cell phones, earbuds/earphones, MP3 players, PDAs, and programmable calculators. Other items may be added to the list as necessary.
- You will be provided with a non-programmable calculator for use during exams.
- All exams are scheduled for 50 minutes. They will begin promptly at 9:00 am and will be collected at 9:50 am.

MAKE-UP EXAMS

Make-up exams will be given for valid excuses only if arrangements are made **before** the scheduled exam. Failure to inform me of an absence from an exam will result in a zero for that exam. **All make-up exams will be substantially different from the exam given at the scheduled time.**

FINAL EXAM SCHEDULE CHANGES

You may take the final exam at a time other than the scheduled time only if you

a) have 3 or more exams scheduled on the same day

b) submit to me a form verified by the registrar (see http://www.arr.ilstu.edu/faculty_staff/final_exam/)

c) make arrangements at least **1 week** before the scheduled exam

GRADING (LECTURE PORTION)

Your score in the lecture part of the class will be based on 10 homework assignments (5 points each), two online quizzes (25 points each), and three exams (two 75-point hour exams and a 150-point final). The final exam will consist of a 75-point portion covering the final third of the course and a 75-point comprehensive portion.

Your lowest 75-point exam score (**excluding the comprehensive portion of the final**) will be replaced by the average of your other two 75-point exams with the following conditions:

a) you must turn in at least 75% of the homework assignments
b) your score can only improve by a maximum of 35 points *(i.e. if you skip an exam your maximum score will be 35 out of 75, or 47% — still an F)*

EXAM SCHEDULE	POINTS
Problem Sets	50
Exam 1 (Monday, September 21)	75
Exam 2 (Wednesday, October 28)	75
Blackboard Quiz 1 (Due by Lab Period 8)	25
Blackboard Quiz 2 (Due by Lab Period 9)	25
Final Exam (7:50-9:50 AM Wednesday, Dec. 9)	
Exam 3 Portion	75
Comprehensive Portion	75
Total (Lecture)	400

OVERALL GRADE CALCULATION

Your final grade will be based on your performance in the lecture and laboratory portions of the course. A final percentage will be calculated based on a weighted average of your lecture (2/3) and laboratory (1/3) percentages. Your final grade will be based upon this final calculated percentage. The guaranteed minimum grading scale is: >90% = A; 80-90% = B; 65-80% = C; 55-65% = D; <55% = F. There may be some **slight** adjustments to the grading scale (downward only, not upward), but **all students having a cumulative score of 50% or less (300 Points or less) will receive a grade of F.**

EXAMPLE FINAL GRADE CALCULATIONS

	Student A	Student B	Student C
Lecture	63.4%	88.5%	68.4%
Lab	88.3%	93.4%	56.7%
Weighted $\left(\frac{2}{3}\text{Lecture}+\frac{1}{3}\text{Lab}\right)$	71.7%	90.1%	64.5%
Final Grade	**C**	**A**	**D**
Comments	Lab usually improves your overall grade as long as you turn in reports and notebook pages on time and write thorough reports		But neglecting to turn in lab reports usually lowers your grade!!

LECTURE SCHEDULE

NOTE: EXAM DATES ARE FIRM, BUT ORDER OF TOPICS MAY DEVIATE FROM THE SCHEDULE

TOPIC	TEXT REFERENCE
Electricity and Electronics (LAB LECTURE)	
*Introduction **(Lab Week 1)**	Ch. 1C
*Components and Simple Circuits **(Lab Week 7)**	Ch. 2 A,C1-C2
*Operational Amplifiers **(Lab Week 8)**	Ch. 3
Introduction	Ch. 1A-E
Chromatography and Electrophoresis	
Chromatographic Theory	Ch. 26
Gas Chromatography	Ch. 27
HPLC	Ch. 28 A-G
Capillary Electrophoresis	Ch. 30 A-C
EXAM 1: MONDAY, SEPTEMBER 21	
Mass Spectrometry	
Atomic Mass Spectrometry	Ch. 11
Molecular Mass Spectrometry	Ch. 20
Electrochemistry	
Activity/Electrochemical Cells	Appendix 2/ Ch. 22 A-D
Potentiometry	Ch. 23 A-H
Voltammetry	Ch. 22E, 25
Signals and Noise	Ch. 5
EXAM 2: WEDNESDAY, OCTOBER 28	
Basic Spectrometry	
Introduction to Spectrometric Methods	Ch. 6
Components of Optical Instruments	Ch. 7 A-E
Atomic Spectrometry	
Atomic Absorption Spectrometry	Ch. 8, Ch. 9 A-D
Atomic Emission Spectrometry	Ch. 10 A
Atomic X-Ray Spectrometry	Ch. 12 A-C
Molecular Spectrometry *(Time Permitting)*	
Molecular Absorption Spectrometry	Ch. 13, Ch. 14
Fluorescence and Phosphorescence	Ch. 15 A-C
FINAL EXAM: WEDNESDAY, DECEMBER 9, 7:50 – 9:50 AM	

** To be covered by Quiz 1 and Quiz 2, available on the course Blackboard site*

IMPORTANT DATES

Monday, September 7:	*Labor Day*
Monday, September 21:	Exam 1
Before 8th Lab Period:	Quiz 1 Due (Blackboard)
Friday, October 9:	Last Day to Withdraw with WX
Before 9th Lab Period:	Quiz 2 Due (Blackboard)
Wednesday, October 28:	Exam 2
November 23-27:	*Thanksgiving Break*
Wednesday, December 9:	Final Exam (7:50 am – 9:50 am)