



SYLLABUS

COURSE OBJECTIVES

1. To study and discuss the theories, principles, and applications of modern instrumental methods, including spectroscopic, surface characterization, thermal, electroanalytical, and chromatographic techniques.
2. To practice laboratory applications of basic instrumental methods and observe the operation of instruments currently in use.
3. To improve understanding of statistical methods for data evaluation through application to quantitative chemical analysis.

COURSE OUTCOMES

1. The students will acquire a detailed understanding of the principles of operation of modern analytical instrumentation.
2. The students will demonstrate critical thinking, quantitative reasoning, and scientific knowledge related to the wide variety of choices that must be made when using instrumental methods to solve analytical problems.
3. The students will acquire more advanced laboratory skills associated with the collection, handling, and evaluation of analytical data. The students will also demonstrate competence in writing scientific reports.

MATERIAL REQUIRED FOR THIS COURSE

All of the following books and supplies are available in the campus bookstore.

Principles of Instrumental Analysis, Douglas A. Skoog, F. James Holler, and Stanley R. Crouch, 6th Edition, Brooks/Cole Thomson Learning, Inc. (2007) – required.

CHE-302 Instrumental Analysis Laboratory Manual, Cedar Crest College, 2009 Edition.

Laboratory Notebook, W. H. Freeman and Company. You may use a notebook, which has been used in a previous laboratory course if sufficient space is available.

Scientific hand calculator.

Eye protection – safety glasses or goggles.

MEETING TIMES

Lecture: Tuesday and Thursday 9:30 – 10:45 AM; Miller 33

| | | | |
|-------------|------------|----------|--|
| Laboratory: | Section 01 | Thursday | 1:00 – 4:00 PM in Oberkotter 3/Miller 30 |
| | Section 71 | Thursday | 6:00 – 9:00 PM in Oberkotter 3/Miller 30 |
| | Section 02 | Friday | 1:00 – 4:00 PM in Oberkotter 3/Miller 30 |

Instructor's Office: Oberkotter 6; Phone extension x3495

Email: Tabrette@cedarcrest.edu

Office Hours: Tues., Thurs., & Friday 11:00 AM – 12:00 NOON (or by appointment)

GRADING SYSTEM

This 4-credit course is divided into two portions: lecture and laboratory. The lecture portion constitutes 75% of the overall final grade, while the laboratory portion constitutes 25%. **You will receive ONE (1) letter grade for the entire course.** However, **you must pass BOTH the lecture and laboratory portions to earn a passing grade in this course.**

Lecture Grade

The Lecture grade for this course is based on, three one-hour exams (300 pts), attendance/class participation (25 pts) and a comprehensive final exam (175 pts).

Homework will be assigned in the classroom from the problems at the end of the chapters in the text and handout exercises by the instructor. The student is expected to complete the homework on their own. The homework will not be counted towards the grade in the class. Answer keys will be posted on the bulletin board outside the instructor's office.

Laboratory Assessment

The grade for the laboratory portion of the course will be based on performance with respect to two items: the actual experiments and an evaluation by the instructor.

There will be twelve (12) laboratory experiments. Students will work in a group on all of the experiments. For each experiment, each group of students will submit **one** laboratory report along with answers to the post-lab questions the next laboratory class after completing the laboratory. Each report will be graded separately. The grades for individual experiments (12 total) will be averaged to produce a single grade applying to all of the experiments. This laboratory report grade will constitute 90% of the final laboratory grade.

The remaining 10% of the final laboratory grade will be assigned by the instructor based on the student's performance with respect to such attributes as:

- Compliance with laboratory safety rules
- Competence with respect to laboratory techniques
- Completeness and organization of laboratory notebook
- Organization and efficiency when performing experiments
- General attitude in the laboratory and the degree of cooperation and contribution when performing experiments with a partner.

In summary, the laboratory grade will be computed as follows:

$$(0.90)(\text{Experiment Average}) + \text{Instructor Evaluation (0 – 10 \%)}$$

Final Grade for the Course

The final average will be computed as follows:

$$(0.75)(\text{Lecture Grade}) + (0.25)(\text{Laboratory Grade})$$

The final letter grade will be awarded according to the following scale:

| | | | | | |
|------------|----|------------|----|------------|----|
| 93 – 100% | A | 80 – 82.9% | B- | 67 – 69.9% | D+ |
| 90 – 92.9% | A- | 77 – 79.9% | C+ | 60 – 66.9% | D |
| 87 – 89.9% | B+ | 73 – 76.9% | C | Below 60% | F |
| 83 – 86.9% | B | 70 – 72.9% | C- | | |

POLICIES

Classroom Attendance

Classroom attendance is mandatory and will be taken each class. Classroom attendance and class participation will have an impact on the student's grade. Students earn 1 pt/class for attending and participating in class.

Attendance on Examination Days

Attendance on exam days is mandatory. If the student is ill or has some other **important** responsibility which prevents her from attending class on a testing day, she must inform the instructor in advance and make arrangements for an alternate testing time. If this policy is followed, a make-up test will be given. If an exam is missed with no advance notice, a make-up test may be given at the discretion of the instructor. In such instances, a valid written excuse is required:

- 1) from a doctor or the school nurse in case of illness.
- 2) from the Dean of Student's Office in the case of a family emergency
- 3) from the student giving a satisfactory and reasonable explanation of why the test was missed.

If these procedures are not followed, no make-up will be given and the student will receive a zero for the missed exam.

Obtaining Assistance

Do not hesitate to seek assistance concerning class lectures, homework assignments, or grading. If the student can not make it to the instructor's scheduled office hours, she should make arrangements to meet with the instructor at an alternative time at both the student's and the instructor's convenience.

Extra Credit Policy

Extra credit opportunities for the entire class may be offered at the instructor's discretion.

Laboratory

Attendance in the laboratory is MANDATORY. All twelve (12) experiments must be completed as scheduled and reports submitted when due. In the laboratory, groups of four students will be working together. During any laboratory period, each group of students will be working on a different experiment. Hence, the specific dates on which a given experiment will be performed will differ for each group of students. The experiments will include electronic balance error determination, Ultraviolet-Visible (UV-Vis) Spectrophotometry, Fluorometry, Infrared (IR) Spectrophotometry, Gas Chromatography (GC), Nuclear Magnetic Resonance (NMR) Spectroscopy, High Pressure Liquid Chromatography (HPLC), Gas Chromatography and Mass Spectrometry (GC/MS), LC/MS/MS, Pyrolysis GC/MS, and Atomic Absorption (AA) Spectroscopy

Honor Philosophy

“The Cedar Crest College Honor Philosophy states that students should uphold community standards for academic and social behavior in order to preserve a learning environment dedicated to personal and academic excellence. Upholding community standards is a matter of personal integrity and honor. Individuals who accept the honor of membership in the Cedar Crest College community of scholars pledge to accept responsibility for their actions in all academic and social situations and for the effect their actions may have on other members of the College community.”

The instructor expects each student to abide by the college’s honor code. This honor code applies to all activities associated with this course. The student should realize that the honor code is an important aspect of the educational process at Cedar Crest College.

Cedar Crest College Faculty and Administration support the following statement concerning Classroom Protocol:

“Appropriate classroom behavior is implicit in the Cedar Crest College Honor Code. Such behavior is defined and guided by complete protection for the rights of all students and faculty to a courteous, respectful classroom environment. That environment is free from distractions such as late arrivals, early departures, inappropriate conversations, and any other behaviors that might disrupt instruction and/or compromise students’ access to their Cedar Crest College education.”

Please be sure to place all cell phones and pagers on vibrate mode during class times.

Community Standards for Academic Conduct:

“Academic integrity and ethics remain steadfast, withstanding technological change. Cedar Crest College academic standards therefore apply to all academic work, including but not limited to, handwritten or computer-generated documents, video or audio recordings, and telecommunications.

As a student at Cedar Crest College, each student shall:

- Only submit work which is his/her own.
- Adhere to the rules of acknowledging outside sources, as defined by the instructor, never plagiarizing or misrepresenting intellectual property.
- Neither seeks nor receives aid from another student, converse with one another when inappropriate, nor use materials not authorized by the instructor.
- Follow the instructions of the professor in any academic situation or environment, including taking of examinations, laboratory procedures, the preparation of papers, properly and respectfully using College facilities and resources, including library and computing resources to ensure that

these resources may be effectively shared by all members of the College community.

- Abide by the Cedar Crest Computer Use Policy.
- If a student perceives a violation of the Academic Standards, he/she will go to their instructor.
- If you are unable to resolve the problem with the instructor, you should go to the chair of the department. If you need further assistance after the consultation with the instructor and the chair, you should see the Provost.”

It is the instructor’s policy to deal with violations of these Standards for Academic Conduct by awarding a grade of 0 for the assignment or examination in question.

Students with Learning Disabilities

The instructor supports the Cedar Crest College policy regarding learning disabilities as follows:

“Students with documented disabilities who may need academic accommodations should discuss these needs with their professors during the first two weeks of class. Students with disabilities who wish to request accommodations should contact the Advising Center.”

CHRONOLOGICAL PLAN FOR THE COURSE

The schedule on the following page lists the dates and topics that constitute the lectures pertaining to this course. A summary of the testing schedule and content is provided. The schedule may be modified throughout the course, as needed.

Testing Schedule Summary

| <u>2009 Date</u> | <u>Test</u> | <u>Material Included</u> |
|-------------------------|--------------------|---|
| Tues 2/17 | Exam 1 | Chapters 1, 5, 6, 7, 13, 14, 15 |
| Thur 3/31 | Exam 2 | Chapters 16, 19, 8, 9, 10, 20 |
| Thur 4/30 | Exam 3 | Chapters 26, 27, 28, 30, 22, 23, 24, 25 |
| TBA | Final Exam | Comprehensive |

Lecture Topics Schedule

| <u>Date:</u> | <u>Subject</u> | <u>Reading Assignment:</u> |
|--------------|--|----------------------------|
| 1/20 | Introduction and Basics of Instrumental Analysis | Chapter 1 |
| 1/22 | Signals & Noise | Chapter 5 |
| 1/27 | Introduction to Spectroscopy | Chapter 6 |
| 1/29 | “ | “ |
| 2/3 | “ | Chapter 7 |
| 2/5 | UV-Vis Spectroscopy | Chapter 13 |
| 2/10 | “ | Chapter 14 |
| 2/12 | Luminescence Spectroscopy | Chapter 15 |
| 2/17 | Exam 1 | |
| 2/19 | Luminescence Spectroscopy | “ |
| 2/24 | Infrared Spectroscopy | Chapter 16 |
| 2/26 | “ | “ |
| 3/3 | NMR Spectroscopy | Chapter 19 |
| 3/5 | “ | “ |
| 3/10, 3/12 | Spring Break | |
| 3/17 | Introduction to Atomic Spectroscopy | Chapter 8 |
| 3/19 | Atomic Absorption Spectroscopy | Chapter 9 |
| 3/24 | Atomic Emission Spectroscopy | Chapter 10 |
| 3/26 | Mass Spectrometry | Chapter 20 |
| 3/31 | Exam 2 | |
| 4/2 | Introduction to Separation Science | Chapter 26 |
| 4/7 | Gas Chromatography | Chapter 27 |
| 4/9 | High Performance Liquid Chromatography | Chapter 28 |
| 4/14 | Capillary Electrophoresis | Chapter 30 |
| 4/16 | Introduction to Electroanalytical Chemistry | Chapter 22 |
| 4/21 | Potentiometry | Chapter 23 |
| 4/23 | Coulometry | Chapter 24 |
| 4/28 | Voltametry | Chapter 25 |
| 4/30 | Exam 3 | |