

PELLISSIPPI STATE TECHNICAL COMMUNITY COLLEGE  
MASTER SYLLABUS

**ANALYTICAL CHEMISTRY**  
**CHEM 2310 (formerly CHM 2310)**

**Class Hours: 3.0**

**Credit Hours: 4.0**

**Laboratory Hours: 5.0**

**Date Revised: Spring  
00**

**Catalog Course Description:**

Principles and practices of quantitative measurements in chemical systems are introduced. Chemical equilibria (acid-base, complexometric, and redox), elementary spectrophotometry, chemical separations--including chromatography, ion exchange, and solvent extraction--are discussed. Course includes 3 hours of lecture and 5 hours of laboratory applications each week.

**Entry Level Standards:**

One year of general college chemistry is necessary for entrance into the course.

**Prerequisite:**

CHEM 1120

**Textbook(s) and Other Reference Materials Basic to the Course:**

Harris, Daniel C. *Quantitative Chemical Analysis*, 5th edition. W. H. Freeman and Company, 1999.  
A bound laboratory notebook.  
A calculator capable of statistical analysis.

**I. Week/Unit/Topic Basis:**

<b>Week</b>	<b>Topic</b>
1	Measurements; Tools of the trade
2	Experimental error; Statistics
3	Calibration methods
4	Chemical equilibrium
5	Titrations
6	Ionic strength; Activity coefficients
7	Monoprotic acid-base equilibria
8	Polyprotic acid-base equilibria
9	Acid-base titrations; Fundamentals of electrochemist

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|----|--|
| 10 | Fundamentals of spectrophotometry      |
| 11 | Applications of spectrophotometry      |
| 12 | Atomic spectroscopy                    |
| 13 | Introduction to analytical separations |
| 14 | Gas chromatography                     |
| 15 | High performance liquid chromatography |
| 16 | Final Exam                             |

## II. Course Objectives\*:

- A. Follow written analytical procedures and write lab reports understandable to others. VI.1.
- B. Understand the underlying principles of statistics in both lecture and lab. VI.1.
- C. Understand chemical equilibria. I.5.
- D. Understand ionic equilibria. I.5.
- E. Understand the principles of spectrophotometry and solve problems involving light absorption and emission. III.1, III.2.
- F. Solve problems dealing with the principles of electrochemistry. I.5.
- G. Calculate efficiencies of separation for solvent extraction and chromatographic processes. I.5.

\*Roman numerals after course objectives reference goals of the university parallel program.

## III. Instructional Processes\*:

Students will:

1. Generate analytical data within acceptable limits of experimental error.  
*Technological Literacy Outcome, Numerical Literacy Outcome*
2. Become proficient in classical and instrumental methods of quantitative chemical analysis common to modern analytical laboratories. *Technological Literacy Outcome, Transitional Strategy*
3. Utilize current chemical reference literature. Information Literacy Outcome
4. Record experimental data and conclusions in a laboratory notebook in a manner acceptable for research and industry. *Communication Outcome, Transitional Strategy, Numerical Literacy Outcome*
5. Determine appropriate method of chemical analysis for a substance based upon certain various physical and chemical parameters. *Problem Solving and Decision Making Outcome, Active Learning Strategy*
6. Understand the theories and principles which underlie observed chemical processes. *Communication Outcome, Problem Solving and Decision Making Outcome*

\*Strategies and outcomes listed after instructional processes reference Pellissippi State's goals for strengthening general education knowledge and skills, connecting coursework to experiences beyond the classroom, and encouraging students to take active and responsible roles in the educational process.

#### **IV. Expectations for Student Performance\*:**

Upon successful completion of this course, the student should be able to:

1. Understand the use and calibration of lab equipment. A
2. Prepare a lab notebook for data collection and reference. A
3. Understand how solutions are prepared and work solution problems involving dilutions. A
4. Understand the safe handling of chemicals and disposal methods of chemical wastes. A
5. Work solution problems using the various concentration expressions. B
6. Convert given measurements to necessary units needed in solving a particular problem. B
7. Understand the concept of significant figures and perform mathematical operations with them. B
8. Distinguish between the different types of experimental error. B
9. Estimate the uncertainty in measurements. B
10. Determine and understand the statistical analysis of experimental data. B
11. Understand the concepts involving the chemical equilibrium constant, K. C
12. Review acid-base concepts like strength, pH and use of ionization constants. C
13. Determine and use the solubility product constant,  $K_{sp}$ , and the effects of complex ion formation. D
14. Understand spectrophotometric concepts like absorbance, transmittance, and Beer's Law, and gain experience with these concepts using instrumentation. E
15. Review the technique of titration and learn a variety of methods to determine information about the analyte. C,D,E,F
16. Review the concepts of electrochemistry and extract chemical information using potentiometry. F
17. Study two means of analytical separations B extraction and chromatography. G

\*Letters after performance expectations reference the course objectives listed above.

#### **V. Evaluation:**

A. Testing Procedures: 60% of grade

Chapter(s) tests, quizzes, problems sets--40%

A comprehensive final exam--20%

Quizzes and exams may not be made up if missed. The Final Exam may be worth more for an excused missed exam. One lab grade may be dropped if all labs are completed.

B. Laboratory Expectations: 40% of grade

Lab notebook - accuracy of results and experimental write-up--40%  
Attendance is required for scheduled lab meetings. All labs must be completed by the end of the last scheduled lab meeting. Lab notebooks will be collected at this meeting. See lab schedule for order of lab experiments and dates of lab meetings.

C. Field Work:

N/A

D. Other Evaluation Methods:

N/A

E. Grading Scale:

90-100	A
80-89.9	B
70-79.9	C
60-69.9	D
<60	F

**VI. Policies:**

Attendance Policy:

Pellissippi State Technical Community College expects students to attend all scheduled instructional activities. As a minimum, students in all courses must be present for at least 75 percent of their scheduled class and laboratory meetings in order to receive credit for the course.