

**CHEM 5 Course Outline as of Fall 2014****CATALOG INFORMATION**

Dept and Nbr: CHEM 5 Title: QUANTITATIVE ANALYSIS

Full Title: Quantitative Analysis

Last Reviewed: 9/8/2014

Units		Course Hours per Week		Nbr of Weeks	Course Hours Total	
Maximum	4.00	Lecture Scheduled	2.00	17.5	Lecture Scheduled	35.00
Minimum	4.00	Lab Scheduled	6.00	6	Lab Scheduled	105.00
		Contact DHR	0		Contact DHR	0
		Contact Total	8.00		Contact Total	140.00
		Non-contact DHR	0		Non-contact DHR	0

Total Out of Class Hours: 70.00

Total Student Learning Hours: 210.00

Title 5 Category: AA Degree Applicable

Grading: Grade Only

Repeatability: 00 - Two Repeats if Grade was D, F, NC, or NP

Also Listed As:

Formerly:

**Catalog Description:**

Principles and methods of analytical chemistry including gravimetric and volumetric techniques and introduction to instrumental analysis involving potentiometry, spectrophotometry and chromatography. Emphasis on quantitative reasoning, written and verbal communication skills and development of precise laboratory techniques. The sequence Chem 1A, 1B and 5 must be completed for entrance into Chem 12A if the student has not completed 4A and 4B.

**Prerequisites/Corequisites:**

Chem 1B.

**Recommended Preparation:**

Eligibility for ENGL 100 or ESL 100

**Limits on Enrollment:****Schedule of Classes Information:**

Description: Principles and methods of analytical chemistry including gravimetric and volumetric techniques and introduction to instrumental analysis involving potentiometry, spectrophotometry and chromatography. Emphasis on quantitative reasoning, written and verbal communication skills and development of precise laboratory techniques. The sequence Chem

1A, 1B and 5 must be completed for entrance into Chem 12A if the student has not completed 4A and 4B. (Grade Only)

Prerequisites/Corequisites: Chem 1B.

Recommended: Eligibility for ENGL 100 or ESL 100

Limits on Enrollment:

Transfer Credit:

Repeatability: Two Repeats if Grade was D, F, NC, or NP

## **ARTICULATION, MAJOR, and CERTIFICATION INFORMATION:**

<b>AS Degree:</b>	<b>Area</b>	Effective:	Inactive:
<b>CSU GE:</b>	<b>Transfer Area</b>	Effective:	Inactive:
<b>IGETC:</b>	<b>Transfer Area</b>	Effective:	Inactive:
<b>CSU Transfer:</b>		Effective:	Inactive:
<b>UC Transfer:</b>		Effective:	Inactive:

**CID:**

**Certificate/Major Applicable:**

Major Applicable Course

## **COURSE CONTENT**

### **Outcomes and Objectives:**

After successful completion of this course, a student will be able to:

1. Perform gravimetric analyses of known compounds and mixtures to accurately identify their chemical compositions.
2. Perform titrimetric analyses of unknown monoprotic and polyprotic acids and bases.
3. Select appropriate indicators, primary standards and indicator electrode systems to perform acid-base titrations.
4. Identify and control the factors that influence experimental errors in gravimetric and volumetric analyses.
5. Perform complexometric titration analyses of samples containing unknown metals.
6. Perform precipitation titration analyses of unknown solutes.
7. Perform oxidation-reduction titration analyses of unknown solutes.
8. Operate such laboratory instruments as analytical balances, pH meters, ultraviolet/visible/infrared spectrophotometers, atomic absorption spectrophotometers, and gas chromatographs observing appropriate techniques and safety precautions.
9. Apply the operating principles of potentiometric instruments including selective-ion electrode systems.
10. Apply the basis of the Beer-Lambert law, and the design and operating principles of modern spectrophotometers.
11. Apply the principles of liquid-liquid and gas-liquid chromatography to the quantitative analysis of unknown mixtures.

12. Utilize spreadsheet and graphing computer software to evaluate laboratory data, and word-processing software to communicate experimental outcomes.
13. Utilize computer interfacing to streamline the process of data collection, spreadsheet computation, graphing and curve-fitting.

### **Topics and Scope:**

#### **LECTURE MATERIAL**

1. Introduction to analytical chemistry
2. Review of essential concepts
3. Safety and ethics of handling chemicals and waste
4. Proper use of fundamental laboratory equipment
5. Proper methods of data collection and formats for written reports
6. Control of experimental error
7. Statistics and analytical quality control and quality management
8. Review of chemical equilibrium
9. Advanced topics in chemical equilibrium
10. Activities and activity coefficients
11. Monoprotic acid-base equilibria
12. Polyprotic acid-base equilibria
13. Acid-base titrations
14. Complexometric titrations using EDTA
15. Electrochemistry and potentiometry
16. Redox titrations
17. Electrogravimetric analyses
18. Design and operation of ultraviolet, visible and infrared spectrophotometers
19. Atomic absorption and emission spectroscopy
20. Applications of x-rays in chemical analysis
21. Mass spectrometry
22. Solvent extraction
23. Chromatographic separation techniques
24. Gas chromatography
25. Liquid chromatography

#### **LABORATORY MATERIAL**

1. Gravimetric analysis of calcium, chloride or sulfate ion.
2. Standardization of volumetric glassware
3. Spreadsheets, graphing and statistics software
4. Preparation and standardization of solutions
5. Titrimetric analysis involving monoprotic and polyprotic acids and bases
6. Oxidation-reduction titrations
7. Complexometric titrations
8. Iodometric titrations
9. Potentiometric titrations
10. Electrogravimetric analysis
11. Atomic absorption analysis
12. Spectrophotometric analysis
13. Quantitative analysis by gas chromatography
14. Infrared spectrophotometric identification of chemical compounds
15. Simultaneous spectrophotometric analysis

## Assignment:

Assignments of Chemistry 5 include:

1. Specific reading and study assignments (averaging 30 pages per week)
2. Completion of end-of-chapter exercises (averaging 10-15 problems per week)
3. Writing (on average) one laboratory report per week
4. Previewing upcoming laboratory experiments, and completing the required pre-laboratory assignments
5. Reviewing an original paper related to the analytical techniques studied in class
6. Midterm and final examinations
7. Lab activities

## Methods of Evaluation/Basis of Grade:

**Writing:** Assessment tools that demonstrate writing skills and/or require students to select, organize and explain ideas in writing.

Lab reports, literature review
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Writing 20 - 40%
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**Problem Solving:** Assessment tools, other than exams, that demonstrate competence in computational or non-computational problem solving skills.

Homework problems
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Problem solving 5 - 8%
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**Skill Demonstrations:** All skill-based and physical demonstrations used for assessment purposes including skill performance exams.

Lab skill evaluation
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Skill Demonstrations 12 - 15%
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**Exams:** All forms of formal testing, other than skill performance exams.

Problem solving & short essay; midterm and final exams
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Exams 40 - 60%
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**Other:** Includes any assessment tools that do not logically fit into the above categories.

None
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Other Category 0 - 0%
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## Representative Textbooks and Materials:

Quantitative Chemical Analysis, by Daniel C. Harris, 7th edition, W. H. Freeman & Co., 2007.

Exploring Chemical Analysis, by Daniel C. Harris, 4th edition, W. H. Freeman & Co., 2009  
Analytical Chemistry: An Introduction, by Skoog, Holler, West and Crouch, 7th edition, Thomas-Brooks/Cole, 2000

