Douglas College

EFFECTIVE: SEPTEMBER 2004
CURRICULUM GUIDELINES

A. Division: Science and Technology

Effective Date: September 2004

B. Department / Program
Area: Chemistry

Revision [ ] New Course [X]

If Revision, Section(s) Revised:

Date of Previous Revision:

Date of Current Revision:

C: CHEM 2315 **D: Introduction to Analytical Chemistry** **E: 5**

Subject & Course No.	Descriptive Title	Semester Credits

F: Calendar Description: This course first offers an introduction to sampling, error and statistical analysis as applied to analytical chemistry. Specific analytical techniques or concepts covered are: gravimetric and volumetric analyses, aqueous solution equilibrium principally involving complexation equilibria, spectrophotometric analysis, electrochemical methods, atomic spectroscopy, and chromatographic methods. These topics will be covered from the point of view of theory, the associated analytical instrumentation and relevant computational methods. The experimental application of this material will be covered in the laboratory experiments (see below)

G: Allocation of Contact Hours to Type of Instruction / Learning Settings

Primary Methods of Instructional Delivery and/or Learning Settings:

Lecture/Laboratory

Number of Contact Hours: (per week / semester for each descriptor)

Lecture: 4 hours/week
Laboratory: 3 hours/week

Number of Weeks per Semester**: 15**

H: Course Prerequisites:

CHEM 1210 (C or better)

I: Course Corequisites:

J: Course for which this Course is a Prerequisite

K: Maximum Class Size:

18

L: PLEASE INDICATE**:**

[ ] Non-Credit

[ ] College Credit Non-Transfer

[X] College Credit Transfer: Requested X Granted

SEE BC TRANSFER GUIDE FOR TRANSFER DETAILS (www.bccat.bc.ca)

M: Course Objectives / Learning Outcomes

Upon completion of this course, the students will:

1. Apply the concepts of precision, accuracy and statistical analysis to a variety of chemical analytical techniques
2. Understand the concepts of gravimetric and volumetric analysis and apply them to a wide variety of problems in analytical chemistry
3. Understand the quantitative principles of aqueous solution equilibria as applied to metal-ligand complexes and carry out detailed calculations on these systems.
4. Understand the basic theory behind various spectrophotometric techniques, produce a block diagram of the associated instrumentation for each and discuss the purpose of each block plus describe the practial considerations appropriate for the application of each method to typical chemical analyses (e.g. sensitivity, detection limits, linear response ranges, interferences, etc).
5. Understand the basic theory behind various electrochemical techniques, such as potentiometry, coulometry and voltammetry.
6. Produce a block diagram of the associated instrumentation for each of these electrochemical techniques and discuss the purpose of each block plus describe the practical considerations appropriate for each method (e.g. sensitivity, detection limits, interferences, etc.).
7. Understand the basic theory behind atomic spectroscopy, produce a block diagram of instrumentation for both emission and absorption modes (flame and graphite furnace) and discuss the purpose and important considerations for each block.
8. Discuss the practical considerations appropriate for the application of these methods to typical chemical analyses (e.g. sensitivity, detection limits, linear response ranges, interferences, etc.)
9. Understand the basic principles associated with chromatography and discuss how these are applied to the various specific applications of chromatography (e.g. solid-liquid, gas-liquid, HPLC, SFC, etc).
10. Produce a block diagram of the associated instrumentation for each of these applications and discuss the purpose and limitations associated with each block.
11. For each method, describe a typical sample that might be separated by this method and discuss the appropriate practical considerations (sensitivity, detection limits, interferences, band broadening mechanisms, repeatability, etc.)

N: Course Content:

1. The concepts of sampling, experimental error, precision, accuracy (introduced in earlier courses) will be expanded upon.
2. The concepts of statistical analysis and calibration as applied to analytical chemistry will be introduced.
3. Gravimetric and volumetric techniques of analysis will be briefly reviewed.
4. The quantitative principles of solution equilibria as applied to metal-ligand complexes will be explored in some detail and applications to complexometric titrations examined.
5. The principles of spectrophotometric analysis will be introduced and their practical application explored.
6. Electrochemical methods (e.g. potentiometry, coulometry, voltammetry) will be introduced, both from the point of view of theory and the associated instrumentation.
7. The principles of atomic spectroscopy will be introduced and the associated instrumentation examined.
8. The basic principles of chromatography will be introduced and the associated instrumentation examined; the focus will be on gas-liquid chromatography and high pressure liquid chromatography.

Laboratory Content:

A selection (approximately 10) of the following experiments will be performed in the laboratory period.

1. Statistics in Analytical Chemistry
2. Aqueous Chemical Equilibria – A Detailed Investigation
3. Detection of Fuel Components of Gas Chromatography
4. Complexometric Titrations
5. Potentiometry – Ion Selective Electrodes
6. Spectrophotometric Determination of Maganese and Chromium in a Mixture
7. Determination of Copper Using Flame Atomic Absorption Spectrometry
8. Separation and Identification of Fatty Acids in Commercial Oil Using Gas Chromatography
9. Soil Sample Extraction and Analysis for Magnesium and Calcium
10. Separation of compounds using high pressure liquid chromatography (HPLC)
11. Caffeine Analysis in Beverages by HPLC
12. Determination of Iron in Cereal by Atomic Absorption
13. Detection of Petroleum Contaminants by Capillary Gas Chromatography
14. Determination of Trace Metals in Human Hair by Atomic Absorption
15. Analysis of Capsaicinoids by Reversed Phase HPLC

O: Methods of Instruction

Lectures, problem-solving sessions and class discussion will be the major methods of instruction in this course. A variety of audio-visual aids and pre-programmed material (as appropriate) will also be used. Problems will be assigned on a regular basis; these will be handed in and evaluated. The laboratory portion of this course will be closely coordinated with the lecture portion of this course and used to illustrate the theoretical and practical material associated with common analytical chemistry techniques.

P: Textbooks and Materials to be Purchased by Students

Harris, D.C., *Quantitative Chemical Analysis*, 6th Edition, 2002

Q: Means of Assessment

The final grade assigned for the course will be based upon the following components:

1. **Lecture Material (70%)**

    a) Two term tests will be given during the semester (20-25%)
    b) A final comprehensive examination to be given during the final exam period (30%)
    c) Any or all of the following evaluations, at the discretion of the instructor: problem assignments, quizzes, projects, class participation [5% maximum] (15-20% in total)

2. **Laboratory (30%)**

    Ten experiments will be performed during the semester and the grade for this portion of the course will be based on (a) the accuracy of the results and/or (b) the written report for each experiment.

R: Prior Learning Assessment and Recognition: specify whether course is open for PLAR

No

Course Designer(s)

Education Council / Curriculum Committee Representative

Dean / Director

Registrar