



**School of Arts & Science**  
**CHEMISTRY AND GEOSCIENCE DEPARTMENT**

**CHEM 224-01**  
**Analytical Chemistry**  
**2015F**

## COURSE OUTLINE

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This course provides an introduction to the theory and practice of chemical separation and identification. The major techniques are examined including chromatography, solvent extraction, spectroscopy and electrochemistry. The problems associated with data acquisition and the statistics of sampling are stressed throughout.

*It is strongly recommended students keep this outline for your records.*

**Prerequisite:** Chem 121 (C grade minimum)

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### 1. Instructor Information

(a)	Instructor:	Blair Surridge ( <a href="http://camosun.ca/learn/programs/chem/surridge.html">http://camosun.ca/learn/programs/chem/surridge.html</a> )		
(b)	Office Hours:	Tues & Fri: 12:00 – 1:00 and Mon: 12:00 – 2:00		
(c)	Location:	Office #: F 350A Fisher Building Lansdowne Campus		
(d)	Phone:	250-370-3438	Cell Phone:	250-661-6701
(e)	Email:	<a href="mailto:SurridgeB@camosun.bc.ca">SurridgeB@camosun.bc.ca</a>		

### 2. Intended Learning Outcomes

At the end of this course, the student will possess an enhanced ability to:

1. Define and calculate the mean, median, mode, variance and standard deviation for a series of replicate analyses. Estimate the population mean from analysis of a small number of trials. Test for the rejection or retention of suspect data. Explain and use the least squares procedure to graph experimental data.
2. Describe and explain the procedures for gravimetric and titrimetric analyses: obtain data that falls within the established margins of error for the methods.
3. Derive and apply the Beer-Lambert law and use internal and external standards to ensure the validity of the analysis. Distinguish between absorption, emission, fluorescence and phosphorescence. Obtain absorption and emission spectra from various sources and perform a complete quantitative analysis on the samples provided. Explain and use light scattering techniques to estimate the turbidity of solutions.
4. Distinguish between the major modes of radioactive decay and between the activity of the sample and the dose received by the absorber. Estimate the age of fossils and artifacts via carbon and argon dating techniques and the concentrations of trace materials using neutron activation and isotope dilution techniques.
5. Identify and describe the mode of operation for the four major types of electrode. Distinguish between constant current and constant potential coulometry and use them to estimate the concentrations of particular ions in solution. Distinguish

between normal and pulsed polarography and analyze polarograms obtained from mixtures of metal ions.

6. Describe, explain and apply the techniques of solvent extraction, distillation, sublimation, and the major forms of chromatography to the separation of a mixture.
7. Discuss the basis for improvements in the signal to noise ratio of a measurement. Distinguish between the Fourier transform and continuous wave methods of recording data. Explain the process of analogue to digital conversion.
8. Construct a null point hypothesis; use one or two tailed significance tests to reject or retain the hypothesis. Use a paired t test to compare two different methods of analysis for the same sample

### 3. Required Materials (available at the Camosun bookstore)

Text	<ul style="list-style-type: none"> <li>◆ “Quantitative Chemical Analysis” 9th Edition, by Daniel C. Harris (Freeman and Company)</li> </ul> <p>Note: eTextbook and softcover versions are available</p>
Other	<ul style="list-style-type: none"> <li>◆ Chem 224 Lab Manual</li> <li>◆ Safety glasses</li> <li>◆ Lab coat</li> <li>◆ A small hard covered laboratory notebook</li> </ul>
In Library On Reserve	<ul style="list-style-type: none"> <li>◆ “Fundamentals of Analytical Chemistry” 8<sup>th</sup> addition, by Skoog, West, Holler, and Crouch</li> </ul>

### 4. Course Content and Schedules (news items, laboratory information, and supplemental learning material can be found on D2L)

#### Lectures:

Monday	10:00 to 10:50 am in Fisher Building, F214
Tuesday & Thursday	8:30 to 9:20 am in Fisher Building, F200

Unit	Topic	Textbook Reference* (Select topics only)
1	Analytical process, measurement, experimental error, and statistics	Ch. 0, 1, 3, and 4
2	Classical methods (Gravimetric and Titration) & Quality Assurance	Ch. 5 & 27
3	Electrochemical Methods	Ch. 14 and 15
4	Spectrochemical Methods	Ch. 18, 19, 20, and 21
5	Methods of Separation	Ch. 23, 24, and 25 (parts of 22)
6	Methods of Calibration and Quality Assurance	Ch.5 Covered in the Lab #2 and throughout the course

- note we will not be covering the sections given in the text in completely. (Specifics are given in the class lecture notes)

## Chem. 224 Lab Schedule Tuesday 2:30-5:20pm in F354

(note: your lab group must consist of no more than 2 students to maximize time on lab instrumentation and equipment)

Week	Lab Date	Lab No.
I	Sept 8 <sup>th</sup>	Lab # 1, Introduction & skills assessment
II	Sept 15 <sup>th</sup>	Lab # 2, External Standard Calibration and Isotopic Dilution Methods of Quantitation
III	Sept 22 <sup>th</sup>	Lab # 3, Analysis of Halide Ions Using Silver Nitrate
IV	Sept 29 <sup>th</sup>	Lab # 4 Concentration Cell & Ion Selective Electrodes
V	Oct 6 <sup>th</sup>	Lab # 5, <b>Grp A:</b> UV/Vis Spectroscopy
VI	Oct 13 <sup>th</sup>	Lab # 5, <b>Grp B:</b> UV/Vis Spectroscopy
VII	Oct 20 <sup>th</sup>	<b>Midterm (2 hrs)</b>
VIII	Oct 27 <sup>th</sup>	Lab # 6, Atomic Absorption Spectroscopy
IX	Nov 3 <sup>rd</sup>	Lab # 7, <b>Grp A:</b> Chromatography Part 1 (GC Analysis of Hydrocarbon Mixture)
X	Nov 10 <sup>th</sup>	Lab # 7, <b>Grp B:</b> Chromatography Part 1 (GC Analysis of Hydrocarbon Mixture)
XI	Nov 17 <sup>th</sup>	Lab #7 <b>Grp A:</b> Chromatography Part 2 (GC/MS and UPLC Analysis of BPA)
XII	Nov 24 <sup>th</sup>	Lab #7 <b>Grp B:</b> Chromatography Part 2 (GC/MS and UPLC Analysis of BPA)
XIII	Dec 1 <sup>st</sup>	Lab#8 Special Project Lab
XIV	Dec 8 <sup>th</sup>	Lab and Lecture Wrap-up and Final Exam Review

### 5. Basis of Student Assessment (Weighting)

Labs	20%
Special Project Lab <sup>1</sup> (Done in week XIII and XIV)	5%
Sapling Homework <sup>2</sup> /Quizzes <sup>3</sup>	25% (12.5% sapling & 12.5% quizzes)
Midterm (Units I, 2, 3, & 4 <sup>4</sup> )	15% (Week VII Lab Period, 2-hour)
Final Exam (comprehensive)	35% (TBA ~Week XV, 3 hours in Dec)

1. Out of class time needed for researching your analysis. Lab work done in week XIII and XIV
2. This online homework software will provide practice questions which are interactive and are not meant to replace the more traditional end of chapter homework questions. Marks are given for correctness and completing each assignment. Sapling Learning can be purchased online. See D2L for instructions. Due dates for each assignment will be provided by your instructor and can be found on the Sapling Learning website.
3. Expect to have a minimum of 4 quizzes (you will have one week notice regarding each quiz)
4. Expected to cover units 1-4 but only part of unit 4 – an outline will be provided ahead of time for the midterm and the final exam.

**Additional Notes:**

- (1) Student must pass the lab and lecture component of the course to obtain credit for Chem 224. All labs are to be attended and individual lab reports completed following the format provided in the lab manual.
- (2) Immediate contact must be made with instructor for missed labs due to illness or family emergencies for arrangements to be made. This should be done by email. For more information see lab manual.
- (3) A test score that is not as high as that of the December final exam will be dropped automatically and its weight redistributed to the final exam. For example, if a low score is obtained on your midterm then your final exam will then be 50% of the course grade!
- (4) No one is allowed to write exams late and there will be no exceptions. Early exam is a privilege and not a right; thus, at full discretion of the instructor. In the event that the midterm is missed the marks will be weighted to the final exam as per point 3) above.

*Important:*

*Students may not use recording devices in the classroom without the prior permission of the instructor. However, the instructor's permission is not required when the use of a recording device is sanctioned by the College's Resource Centre for Students with Disabilities in order to accommodate a student's disability and when the instructor has been provided with an instructor notification letter which specifies the use of a recording device. Recordings made in the classroom are for the student's personal use only, and distribution of recorded material is prohibited. Cell phones should be turned off while in class.*

**6. Grading System**

*(No changes are to be made to this section, unless the Approved Course Description has been forwarded through EDCO for approval.)*

**Standard Grading System (GPA)**

Percentage	Grade	Description	Grade Point Equivalency
90-100	A+		9
85-89	A		8
80-84	A-		7
77-79	B+		6
73-76	B		5
70-72	B-		4
65-69	C+		3
60-64	C		2
50-59	D	Minimum level of achievement for which credit is granted; a course with a "D" grade cannot be used as a prerequisite.	1
0-49	F	Minimum level has not been achieved.	0

**Temporary Grades**

Temporary grades are assigned for specific circumstances and will convert to a final grade according to the grading scheme being used in the course. See Grading Policy E-1.5 at [camosun.ca](http://camosun.ca) for information on conversion to final grades, and for additional information on student record and transcript notations.

Temporary Grade	Description
I	<i>Incomplete:</i> A temporary grade assigned when the requirements of a course have not yet been completed due to hardship or extenuating circumstances, such as illness or death in the family.
IP	<i>In progress:</i> A temporary grade assigned for courses that, due to design may require a further enrollment in the same course. No more than two IP grades will be assigned for the same course. <i>(For these courses a final grade will be assigned to either the 3<sup>rd</sup> course attempt or at the point of course completion.)</i>
CW	<i>Compulsory Withdrawal:</i> A temporary grade assigned by a Dean when an instructor, after documenting the prescriptive strategies applied and consulting with peers, deems that a student is unsafe to self or others and must be removed from the lab, practicum, worksite, or field placement.

## 7. Important Dates

Week

III Sept. 16: Fee deadline

VI Oct.13: Thanksgiving Monday-College Closed

XI Nov. 11 (Tuesday): Remembrance Day – College Closed

XIV Exam Period for Winter 2014 begins

Use this link to check out scholarships and bursaries

<http://camosun.ca/learn/calendar/current/pdf/financial-assistance.pdf>

## 8. Recommended Materials or Services to Assist Students to Succeed Throughout the Course

### LEARNING SUPPORT AND SERVICES FOR STUDENTS

There are a variety of services available for students to assist them throughout their learning. This information is available in the College calendar, at Student Services or the College web site at [camosun.ca](http://camosun.ca).

### STUDENT CONDUCT POLICY

There is a Student Conduct Policy **which includes plagiarism**. It is the student's responsibility to become familiar with the content of this policy. The policy is available in each School Administration Office, at Student Services and on the College web site in the Policy Section.