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| CAMOSUN COLLEGE | ***School of Arts & Science***<br>***CHEMISTRY AND GEOSCIENCE DEPARTMENT***<br>**CHEM 259-section**<br>**QA in Environmental Chemistry**<br>**Semester/Year, eg, 2007F or 2007Q1** |

# COURSE OUTLINE

**The Approved Course Description is available on the web @ _____**

Ω *Please note: this outline will be electronically stored for five (5) years only. It is strongly recommended students keep this outline for your records.*

## 1. Instructor Information

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|---|---|---|---|---|
| (a) | Instructor: | Warren Drinnan | | |
| (b) | Office Hours: | Thurs: 1030 – 1130; Fri – 1230-1330 | | |
| (c) | Location: | F314A | | |
| (d) | Phone: | | Alternative Phone: | 888-9328 |
| (e) | Email: | drinnan@camosun.bc.ca | | |
| (f) | Website: | | | |

## 2. Intended Learning Outcomes

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

Upon completion of this course the student will be able to:

1. Overview of Environmental Monitoring
   - Develop a program of quality assurance/quality control (QA/QC) protocols for a field and laboratory lake monitoring study.
   - Identify and avoid potential sources of contamination of samples through the application of quality control and quality assurance methods.
2. Preparation for Field Monitoring [Two approximately half day field trips (on a Saturday or a Sunday) are required to collect water and sediment samples.]
   - Prepare and calibrate water sampling instruments and equipment.
   - Prepare sampling containers for the collection of water and sediment samples to be used for laboratory analysis.
3. Laboratory Techniques and Quality Control/Quality Assurance
   The laboratory component will feature hands-on analysis of the samples collected during the field component. Students will work in groups of two. A list of equipment that will be used includes:
   - Atomic Adsorption spectrophotometer (copper in sediments)
   - UV/VIS spectrophotometer (phosphorus in water)
   - Ion selection electrodes (calcium in water)
   - Titration apparatus (dissolved oxygen in water)
   - pH meters

   At the end of this laboratory component students will be able to:
   - Identify and use appropriate QA/QC procedures for tracking field and lab samples and the resultant data.

- Use laboratory equipment and procedures, including quality assurance monitoring of data.
- Develop and interpret standard curves and laboratory control charts.
- Interpret percent recovery data.

4. Data Analysis and Reporting for Chemistry
   - Use the spreadsheet Excel for organizing, copying and deleting data, and preparation of tables and graphs for report presentation.
   - Use graphical packages with Excel to produce linear regressions, vertical profile plots of field data and control charts of laboratory quality assurance data.
   - Perform basic statistical analysis on field and laboratory data including standard deviation, limit of quantification, limit of detection, mean, median and mode and comparison of two sets of data (students t-test).
   - Prepare a scientific data report of professional quality on the combined results of the field and lab data collected during the course.

## 3. Required Materials

(a) Texts - none

(b) Other – Drinnan, 2009: Chemistry and Computer Manusals – in house produced

## 4. Course Content and Schedule

**CHEMISTRY LAB SCHEDULE**

| WEEK | DATE | GROUP | ACTIVITY |
|---|---|---|---|
| 1 | Jan. 09 | ALL | - Introduction to course; selection of student groups.<br>- Introduction to QA/QC.<br>- Monitoring strategies; field protocols; introduction to field equipment.<br>- Field mobilization for Trip I: check lists; bottle preparation; instrument calibration. |
| 2 | Jan. 16<br>(Dry Run ) | A<br>B<br>C | - Introduction to Methods: Copper in sediments (Atomic Adsorption).<br>- Introduction to Methods: Phosphate (UV/VIS Spectrophotometer).<br>- Introduction to Methods: pH; Ca; Dissolved Oxygen. |
| 3 | Jan. 23<br>(Dry Run) | C<br>A<br>B | - Introduction to Methods: Copper in sediments (Atomic Adsorption).<br>- Introduction to Methods: Phosphate (UV/VIS Spectrophotometer).<br>- Introduction to Methods: pH; Ca; Dissolved Oxygen. |
| **4** | **Jan. 25** | | **- Field Trip I** |
| 4 | Jan. 30<br>(Dry Run) | B<br>C<br>A<br>ALL | - Introduction to Methods: Copper in sediments (Atomic Adsorption).<br>- Introduction to Methods: Phosphate (UV/VIS Spectrophotometer).<br>- Introduction to Methods: pH; Ca; Dissolved Oxygen.<br>- Wet weight measurements of sediments; dry sediments from Trip I |
| 5 | Feb. 06<br>(Trip I) | A<br>B<br>C | - Digestion of sediments for copper analysis and AA (Trip I)<br>- Analysis of water samples for phosphates from Trip I; dry sediments<br>- Analysis of water samples for dissolved oxygen, pH and calcium |
| 6 | Feb. 13<br>(Trip I) | C<br>A<br>B | - Digestion of sediments for copper analysis and AA (Trip I)<br>- Analysis of water samples for phosphates; dry sediments (Trip I)<br>- Analysis of water samples for dissolved oxygen, pH and calcium (Trip I) |

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| 7 | Feb. 20 | ALL | - Reading Break. No lab this week. |
| 8 | Feb 27 (Trip I) | B | - Digestion of sediments for copper analysis and AA (Trip I) |
| | | C | - Analysis of water samples for phosphates; dry sediments (Trip I) |
| | | A | - Analysis of water samples for dissolved oxygen, pH and calcium (Trip I) |
| | | ALL | - Prepare for Trip II. |
| **9** | **Mar. 01** | **-** | **- Field Trip II** |
| 9 | Mar. 06 (Trip II) | A | - Digestion of sediments for copper analysis and AA (Trip II) |
| | | B | - Analysis of water samples for phosphates; dry sediments (Trip II) |
| | | C | - Analysis of water samples for dissolved oxygen, pH and calcium |
| 10 | Mar 13 (Trip II) | C | - Digestion of sediments for copper analysis and AA (Trip II) |
| | | A | - Analysis of water samples for phosphates; dry sediments (Trip II) |
| | | B | - Analysis of water samples for dissolved oxygen, pH and calcium (Trip II) |
| 11 | Mar. 20 (Trip II) | B | - Digestion of sediments for copper analysis and AA (Trip II) |
| | | C | - Analysis of water samples for phosphates (Trip II) |
| | | A | - Analysis of water samples for dissolved oxygen, pH and calcium (Trip II) |
| 12 | Mar. 27 | ALL | - Trip to Axys Analytical Labs in Sidney<br>- Finish Trip II analysis; complete data entry; report preparation |
| 13 | Apr. 03 | ALL | - Finish Trip II analysis; complete data entry; report preparation |
| 14 | Apr. 10 | ALL | - Good Friday. No Lab. |

**NOTES:**

1. **Final Report**. Each student will prepare a separate report. An outline and a disk of all relevant data compiled in several spread sheet files will be provided. Relevant background papers and reports are available on a sign-out basis from the instructor. Sections of the report will be assigned as lab exercises to facilitate the preparation of the final version.

   **NOTE: The report is due on April 24, 2009. This is the last possible date to submit marks to registration DO NOT BE LATE WITH THE REPORT. A grade based on course performance (without the report) will be submitted if a report is not handed in.**

2. **Chemistry Lab Exercises**. Before each week's lab, a pre-lab assignment must be handed in. At the end of each lab period, the data sheets are to be correctly filled out and placed in the data binder and the data entered into the database. No original data sheets are to leave the lab!! Marks will be deducted for incorrect or absent data sheets or data entry - these will be assigned to the group responsible.

3. **Computer Lab Exercises**. A computer lab exercise will be assigned each week which are due the beginning of the chemistry lab on the Friday of the following week. Late assignments will be assigned a penalty of 20% of the lab mark. Labs will not be accepted after that time and a mark of "0" will be given.

**COMPUTER LAB SCHEDULE**

The computer lab component will include some lecture material on environmental chemistry and quality assurance. However, the main thrust will be a series of tasks which constitute the different data applications that are to be used in the preparation of the final report. In general, a different task will be covered during each week but time for data entry and report preparation will also be provided. You are to

hand in both a paper copy of the assignment as well as a computer disk or similar storage devise. **NOTE: Make sure all material is backed up in class onto two disks - a master that you keep for yourself and a copy which will be handed in (and returned). Full names on all materials please.** Labs are due on the Friday, one week after it is assigned.

| WEEK | OBJECTIVE AND ASSIGNMENT |
|---|---|
| 1 | Introduction to Excel. Data entry, copying and deleting formulas; simple math; use of Formula Wizard; confirmation of data entry.<br><br>**Assignment 1.** Preparation of Excel file; entry of lab data; use of formulas for calculations. |
| 2 | **Introduction to Graphs**. Organization of Data (x and y columns); introduction to Chart Wizard; graphing a linear regression (e.g., a standard curve).<br><br>**Assignment 2.** Preparation of a standard graph from a given set of standard. Use of the trend line formula to determine the concentration of several unknown solutions. |
| 3 | **Preparation of Control Charts.** Principles behind control charts; data entry; preparation of a control chart from a given set of data.<br><br>**Assignment 3**. Preparation of a Control Chart from selected copper standards from 2001 data set |
| 4 | **Chem 259 Data Entry Protocols**. Data entry of examples of laboratory data following Chem 259 data protocols.<br><br>**Assignment 4.** Completion of data entry and formulas. |
| 5 | **Preparation of depth profile graphs**. Setting up the x and y data columns; plotting the down and up data (two profiles in single graph); plotting the mean values for each parameter against depth; plotting of several parameters on one graph.<br><br>**Assignment 5.** Preparation of a depth profiles. |
| 6. | Reading Break |
| 7 | **Control Chart** Based on present dry run data.<br><br>**Assignment #6.** Submit a full-sized control chart for pH, calcium, total phosphorus, dissolved oxygen and total copper, based on the combined data of all groups from this year's Dry Run data. |
| 8 | **Basic Statistics**. Standard deviation, limit of quantification, limit of detection; calculation of mean, median and mode; calculation of standard deviation, LoQ and LoD from a data set; comparison of two sets of data (students t-test).<br><br>**Assignment 7**. Determine the LoQ and LoD from the copper standards data file provided. Compare different data sets to determine statistical differences.. |
| 9 | **Analysis of Variance** (Anova) of simple data set.<br><br>**Assignment 8.** Determine whether there are differences between different lakes and rivers for phosphorus and sediment copper. |
| 10. | **Data Entry and Report Preparation**. Draft report preparation. |

**Assignment 9.** Preparation of the "Methods" sections of the report.

10 **Data Entry and Report Preparation**. Entry of 2003 results.

**Assignment 10** Preparation of the "Quality Assurance" Section of the report.

12 **Data Entry and Report Preparation**.

**Assignment 11**. Presentation of the Field Data from Trip I & II (data tables and graphs).

13 **Data Entry and Report Preparation**. Continued entry of 2003 results and draft report preparation.

**Assignment 12.** Data summary tables for calcium, pH, dissolved oxygen, phosphate, percent moisture and copper results from Field Trip I

14 Complete Data Entry and Report Preparation.

**Assignment 13.** Presentation of Trip II results - data summary tables for calcium, pH, dissolved oxygen, phosphate, percent moisture and copper results.

## 5. Basis of Student Assessment (Weighting)

*(Should be linked directly to learning outcomes.)*

(a) Chemistry Lab and pre-lab weekly assignments
(b) Computer Lab weekly assignments

(b) Quizzes - none

(c) Exams - none

(d) Other – major data report at end of semester (~40 pp)

## 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 |

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| 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** for information on conversion to final grades, and for additional information on student record and transcript notations.

| Temporary Grade | Description |
|---|---|
| **I** | *Incomplete*: 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** | *In progress*: 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. *(For these courses a final grade will be assigned to either the 3rd course attempt or at the point of course completion.)* |
| **CW** | *Compulsory Withdrawal:* 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. 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.

### 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.

ADDITIONAL COMMENTS AS APPROPRIATE OR AS REQUIRED