CIV ENV 365: Environmental Laboratory (Winter 2016)

Syllabus
December 30, 2015

Thursday 1:00–6:00 pm in Tech Room A147/A151
Jean-François Gaillard, Tech A324, (jf-gaillard@northwestern.edu)
Teaching Assistant: Carolyn Wilke (CarolynWilke2013@u.northwestern.edu) Room A225
Website: CANVAS

Abstract: Analytical methods for environmental engineers. Laboratory methods and interpretation of results for the chemical analyses of water samples.

1 Course Objectives
In this laboratory class you will work with a laboratory partner to perform a complete analysis of the 3 water samples. You will then interpret the results of these analyses using the concept and the tools that you have learnt in Aquatic Chemistry: CIV ENV 367. Specific objectives are:

1. to learn basic chemistry laboratory skills used by environmental engineers for assessing the chemical quality of a water sample
2. to learn how determine concentrations of key chemical species
3. to be able to plan and conduct and experiment
4. to be able to effectively report, analyze and interpret laboratory results

2 Textbooks

- **Reading**: Analytical Chemistry 2.0 by David Harvey (2000)
  It is an e-book, that is made available by the author after being printed for a few years by a publisher. It is a great resource, please download your copy from Canvas, you will find it in the first module. For each of the experiments, reference will be made to various chapters of this book.

- **Additional Recommended Readings**: In addition, a few books will be made available in the teaching lab, such as:
3 Prerequisites
• Aquatic Chemistry CIV ENV 367
• Computer Programming/Use: Basic understanding of ChemEq – or equivalent.

4 Grading
Final Grade = Laboratory reports (60%) + Final report and presentation (30%) + Lab book (10%)

5 Additional Information
• Computer Use: Students are encouraged to use standard computational programs (i.e., MATLAB or equivalent – i.e., SCILAB –, Python, or R) to perform some calculations. Examples are presented in the textbook for using either Excel and R for performing calculations required for calibrations purposes. Information about downloading R will be given on CANVAS.
• Class Participation: Attendance to all the experiments is required.

6 Weekly Schedule & List of Experiments
A set of 8 experiments will be performed during the duration of the quarter. The first experiment will be performed in parallel by all the groups and focuses on the determination of pH. This experiment will be performed on the first week of class. The next 7 experiments will be performed each week on a rotation basis that will be established in the first week of classes. The last 2 weeks of the quarter will be devoted to completion of the analyses and the interpretation of the results based on performing chemical speciation calculations using the methods and tools that were developed in CIV ENV 367: Aquatic Chemistry.

2. Following Weeks:
   • Alkalinity and determination of $pK_a$: Computerized titration method.
   • Hardness, TOTCa & TOTMg: Flame Atomic Absorption Spectroscopy – FAAS – and EDTA titration
   • TOTNa, TOTK, and TOTLi: by Flame Atomic Emission Spectroscopy – FAES –
   • Major and Minor Anions: Ion Chromatography – IC –
   • Nutrients: TOTPO$_4$ and TOTNH$_3$: Spectrophotometric methods: Soluble Reactive Phosphorus (SRP) and Ammonium by colorimetry
   • Trace metal analysis: Analysis of dissolved Zn by Graphite Furnace Atomic Absorption Spectroscopy using Zeeman background correction – ZGFAAS –
   • Dissolved Organic Carbon: Measurement of DOC by high temperature catalytic oxidation
3. Weeks 9 and 10: Redos and Presentation/Discussion of Results.
The last 2 weeks of the class will be dedicated to:
   (a) Redoing analyses that you may have had problems with, i.e., analyses that you think are not accurate or have poor precision, and
   (b) Presenting analytical results and their interpretation on the last week of class.
You will have to interpret your analytical results by performing speciation calculations using the skills that you have developed in CIV ENV 367: Aquatic Chemistry and characterize the different waters that you have analyzed, i.e., provide a potential source for the water samples based on their chemistry.