

EVE 537 Environmental Analysis and Instrumentation

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Summer B Semester
Monday-Friday, 9:00 am – 4:00 pm
Wednesday, 5:00 – 8:00 pm
Jennings Hall 314

Course Description: This course will examine laboratory and field techniques useful in designing field studies and quantifying environmental conditions. Students will participate in the design of a field study and collect sediment and water samples for analysis. In addition, this course will cover fundamental principles of instrumental chemical analysis and practical applications of molecular spectroscopy and atomic spectroscopy. These two instruments are widely used in environmental problem solving. Lectures will cover the basic concepts of good laboratory practices, field study sampling techniques, chemical analysis and the fundamental principles of the analytical techniques to be used. In the laboratory, students will gain hands-on experience both by performing a series of required basic chemical determinations and by undertaking a special project. Students will prepare written reports describing the methods, the theory underlying those methods, results, and figures of merit.

Course Objectives: This course is designed for educators and graduate students interested in environmental analysis and assessment. Specifically, the goals of this course are to:

1. Provide students with a general background in detection and quantification techniques commonly used in environmental analyses.
2. Inform students about the variety of instrumentation and techniques commonly used in the biological, chemical and physical analysis of the environment.
3. Explore the process of conducting environmental assessments, from sample collection to final report writing.

Course Outcomes: Upon completion of this course, students will be able to:

1. Conduct basic laboratory exercises using analytical balances, pH meters, muffle furnaces, ovens, micro-pipeting techniques and general clean laboratory practices.
2. Describe the chemical principles and instrumentation used in molecular and atomic absorption spectrophotometry.
3. Measure the concentration of unknown quantities of environmental contaminants using molecular and atomic absorption spectrophotometry.
4. Design and conduct basic marine ecology field studies and establish marine aquaria.
5. Maintain laboratory notebooks and prepare written laboratory reports describing the results of environmental analyses.

Modes of Instruction:

This course will consist of lectures, demonstrations and “hands on” laboratory and field activities. Students will work individually and in small groups to make observations and collect data during the laboratory and field visits.

Course Requirements and Evaluation: All students will be expected to maintain a laboratory notebook containing details concerning lectures, laboratory exercises and demonstrations, field sampling activities and written assignments. Class attendance is mandatory.

Students will be assessed using the following criteria.

Laboratory notebooks	(30%)
Written laboratory reports (2)	(50%)
Participation in classroom, laboratory and field exercises	(20%)

Students are required to maintain a laboratory notebook. The notebooks will be reviewed and evaluated upon completion of the course. Students will be required to prepare two written laboratory reports (select 2 of 3 topics: molecular spectroscopy, atomic absorption spectroscopy, marine aquaria and field sampling). Students will work in groups but will prepare individual notebooks and reports. Each report should contain an introduction explaining the chemical principles of each method, a description of the instrumentation used, the analytical methods, the results of the experiment, and a discussion of the significance of the results to the environment.

Accommodations

If you need course adaptations or accommodations due to a disability, if you have emergency medical information to share with me, or if you need special arrangements in case the building must be evacuated, please make an appointment to see me as soon as possible.

Select Bibliography

The resources identified below are available to the students in addition to the required readings assigned from the reading packet available from the SCSU bookstore. The assigned readings are identified in the course outline for each class meeting.

Reading Packet

A reading packet will be required reading for this class. The assigned readings are listed for each class meeting. Students are **required** to read each assigned reading prior to the class meeting. Reading packets available from instructor.

Books

Boehnke, D.N. and Delumyea, R.D. 2000. Laboratory experiments in Environmental Chemistry. Prentice Hall, Upper Saddle River, NJ. 279 pp.

Harvey, D. 2000. Modern Analytical Chemistry. McGraw-Hill. 798 pp.

Skoog D. A. and West D.M. 1979. Analytical Chemistry. Third Edition. Holt, Rinehart and Winston, NY. 685 pp.

Sumich J.L. and Dudley, G.H. 1996. Laboratory and Field Investigations in Marine Life. East Coast Version. McGraw-Hill. 203 pp.

Vandecasteele, C. and Block, C.B. 1993. Modern Methods for Trace Element Determination. John Wiley and Sons, New York. 330 pp.

Other introductory analytical chemistry or instrumental analysis text may be appropriate.

Zottoli, R. 1978. Introduction to Marine Environments. Second Edition. C.V. Mosby Company. 252 pp.

Environmental Journals at the Buley Library

Environmental Science and Technology

American Laboratory, Analytical Chemistry

Journal of Chemical Education, Talanta (International Journal of Pure and Applied Chemistry)

Marine Pollution Bulletin, Estuarine, Coastal and Shelf Science

Estuaries, Environmental Geology

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	Topic/Activity	Assignment
Monday		
9:00 am – 12:00 pm	Introduction – Laboratory safety, hot plates, weighing, water purification, pipeting, glassware, ovens, pH meters.	Experiment 1 Morton, 2001 Wenzel and Austin, 2001
1:00 pm – 4:00 pm	Absorption spectroscopy techniques. Beers law. Spectroscopic analysis of sulfate.	Absorptiometric Analysis lecture CuSO ₄ Lab
Tuesday		
9:00 am – 12:00 pm	Excel spreadsheets and data analysis. Seawater Chemistry (DO/Salinity/Temperature/Nitrogen)	Computer Laboratory
1:00 pm – 4:00 pm	Aquarium Design and Set-up	Marsh Collection
Wednesday		
9:00 am – 12:00 pm	Spectroscopic analysis of iron	Experiment 9
1:00 pm – 4:00 pm	Field sampling design (Branford River) Where to sample and why. Field sampling Techniques (Group decision) Branford River tour – Power Point	Breslin and Sañudo- Wilhelmy (1999) Experiment 2
Thursday		
9:00 am – 4:00 pm	Branford River sampling Collect sediment and water samples	Breslin and Sañudo- Wilhelmy (2001)
Friday		
9:00 am – 12:00 pm	Process sediment and water samples. Sediment moisture content.	
1:00 pm – 4:00 pm	Data compilation and report writing	

Monday

9:00 am – 12:00 pm	Grain size analysis and sediment characteristics. Sediment loss on ignition. Prepare Samples – mortar and pestle	Sample Preparation Chapter 2
1:00 pm – 4:00 pm	Sediment digest techniques/procedures. Sample preparation/clean techniques. Sediment Metal Contamination	EPA Method 3050 Lecture

Tuesday

9:00 am – 12:00 pm	Acid digest of Branford river sediment	
1:00 pm – 4:00 pm	Filtering and processing of sediment digests. Atomic absorption spectrophotometry lecture	Atomic Spectroscopy Chapter 17 Chapter 5

Wednesday

9:00 am – 12:00 pm	Preparation of standard solutions. Atomic absorption analysis of copper and iron.	Experiment 10
1:00 pm – 4:00 pm	Data analysis, literature search and report writing. Outer Island - Intertidal zonation	Lecture

Thursday

9:00 am – 12:00 pm	Outer Island field trip, tide pool studies, salinity, dissolved oxygen. Transect studies, plant and invertebrate studies.	Zottoli, 1978 Chapter 6
1:00 pm – 4:00 pm	Outer Island field trip (continued).	

Friday

9:00 am – 12:00 pm	Data processing, report writing, plant pressing. Aquaria function and design.	Hughes, 1993 Marine Microcosm
1:00 pm – 4:00 pm	Report writing/data processing	

Wednesday

5:00 pm – 8:00 pm	Report submissions, Review Lab Clean-up	
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