ENVR 411 LABORATORY TECHNIQUES AND FIELD MEASUREMENTS

Lectures - Tuesday 12:30-1:45 pm, McGavran-Greenberg 2303
Labs - Wed 2:30pm-6:00pm, 1204 Hooker (Must have lab safety certification; please see below.)
Post Lab Tutorial (optional) - Thurs 12:30-1:30

Course Credits: 3

Lead Instructor
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Office Hours: Tues 2pm - 3pm or by appointment

IMPORTANT NOTE

All registered students must provide the TA with certification that they have taken and passed the Environment, Health, and Safety (EHS) Laboratory Training examination before they will be permitted to participate in this class.

Since there have been system failures in the past, print out a copy of your answers to the exam (which is at the end of the on-line training unit) before submitting it. If the system fails and you are unable to go back to the page with your answers, you can mail a copy to EHS at the address on their webpage. Please forward a copy of the certification of your success at the exam (an email that you will receive from EHS) to Howard Weinberg no later than the 2nd week of class to be permitted to maintain enrollment.

Objectives

Learn competent laboratory, field, analytical thought, and management skills.

These skills include:

1. An understanding of the principles of environmental processes that involve chemical, biological, physical, and engineered techniques.
2. Disciplined and organized report writing.
3. Advanced literary skills so that reports reflect accurately and clearly on process and can be understood without misunderstanding by others.
4. Oral skills, particularly the ability to present reasoned thoughts in group discussions.
5. Advance numerate skills and fluency with the use of computer software programs for data analysis and report preparation, and appropriate data interpretation.
6. A strong grounding in statistical analysis to afford quality assurance and control to data acquisition, interpretation and analysis.

7. Critical examination of current techniques for collecting surface water, groundwater, soil and atmospheric samples to characterize chemical, biological, and physical properties.
8. Laboratory skills and techniques with relevant application to companion courses.

Grading Guide

ENVR 411 lab reports and results are graded on presentation and interpretation of results in the same way you would be assessed if you were performing experimental research. Where appropriate this includes how close the value you report for your unknowns lies to the true value; that is, you are graded on the accuracy of your results. The experiments are relatively straightforward and "work", except for those occasional times when an instrument malfunctions or the extremely rare instance of a "bad" unknown. So grading on the basis of accuracy is as reasonable and rational a measure of lab technique and performance as anything else, and much less subjective than most.

The Lab Report

All students are required to have a laboratory notebook with numbered pages. Students may purchase these independently. The book should have a hard cover with secure binding at the edge and contain a minimum of 150 sheets sized 11.75 by 9.25 inches.

All information, data, calculations, notes, etc. should be recorded directly into this notebook and not on scrap paper. Writing should be clear and concise and in ink. Errors should be crossed out with a single line and marked with your initials, and the correction written next to it.

Before entering the laboratory, the student should become thoroughly familiar with the experiment and prepare the notebook to make record keeping and report writing more convenient. The instructor will make office hours available ahead of the lab class so that you can consult with him if you have any queries or concerns (see under General Information.)

Basic Grading Procedure

Formal lab reports are required for all experiments. The required sections for your report are described in the link Writing Reports along with the number of points (out of 100) that can be awarded for that section. The semester grade is the average of the grades received for each of the reports.

The specifics for the presentation of your experimental data, analysis, and intrepretation will be shown in the individual lab instructions so please read these carefully before, during, and after your laboratory assignment.

Generally, points will be deducted for omissions, calculation errors, poor technique in the laboratory, failure to follow instructions, disorganized reports, poor lab book records, and accuracy of your results. Labbooks will be periodically reviewed during the lab sessions by the TA and instructor. Each experiment has its own tolerance or window within which your result must fall for a particular grade. For example, if the true value for your unknown is 1000 (in whatever units), and the tolerance for that experiment is 3 parts-per-thousand (ppt) or 0.3% relative error, your reported result must fall between 1000 +/- 3, (from 997 to 1003) to earn a grade of 30. If your result lies outside this range, but within the next set of 3 ppt windows, 1000 +/- 6, you earn a grade of 25, and so forth.

Report Due Dates

Lab reports are due one week after each experiment is completed unless otherwise stated by the instructor. This means that they should be handed into the instructor at the beginning of the lab held the week following. Reports prepared hurriedly are extremely prone to simple calculation errors, which negate even the most painstaking lab work. 5 points will be deducted from the total score if the report is handed in during the 24 hours following this deadline. An additional 5 points will be deducted in each subsequent 24 hour period. Unless there are exceptional circumstances, which must be discussed with and approved by the instructor in advance, reports not handed in by 5pm on the Friday following the initial deadline will generate a score of "0" for that report.

Extra Work

You may come in and work at extra times other than your normal day in the lab if you are unable to complete a particular experiment during the prescribed time. Please coordinate with the Teaching Assistant.

Working outside the normal laboratory hours (8.30am to 5.30pm) is not permitted.

Important Lab Practices

The Laboratory Instructors and Managers have very strong feelings about safety glasses, the instruments, and cleanliness:

Lab Safety Class. UNC Environment Health and Safety require all students who work in laboratories to attend a training session before they begin their work. More details about this class can be found at http://ehs.unc.edu/training/schedule.shtml.

Safety Glasses. When handling any chemical, safety glasses (provided by the laboratory) must be worn. The first time a student is discovered working in the laboratory without safety glasses on, a warning will

be issued; the second time, that person's name will be posted on a Safety Glass List in the laboratory; the third time, the person will be excused from the laboratory for that day. You do not wish to ask what will happen on the fourth such incident.

Laboratory Instruments. If the area around a laboratory instrument is left dirty, if the instrument is left on when it is requested to be turned off, or if an instrument is otherwise abused, all the people assigned to that instrument on that day will be penalized an appropriate amount of points on their report. Check your instruments before you leave!

Cleanliness. A student is responsible for keeping the entire area around his or her work station clean, including the shelves, during the entire time of the laboratory. Wipe up spills immediately. Everyone is to pitch in to keep common work areas, such as in the hoods, clean. It is not the job of the instructors to clean up after the students.

Guide for Complete Lab Reports

One of the goals of this class is to fine-tune your laboratory and field sampling skills as appropriate for the handling of environmental samples. Another goal is to ensure that students learn how to present the results of their work in a research context. This doesn't mean writing extended lab reports but rather having structure and attention to relevant detail. This is a "team-taught" class by several different researchers each of who has developed their own unique style to writing and reporting that has become widely accepted in the peer-reviewed literature. You will have the opportunity during this course to explore these styles and perhaps, by the end of the course, you will have developed your own that will help you become a proficient researcher.

Listed below is the general template for how you should approach the presentation of your report. Individual lab assignments will include specific details that the tailored report should address. Please read these in advance so that you can clarify the expectations with your lecturer before you start writing your laboratory reports. The instructor will indicate if the report should be submitted in hard copy or electronically.

Instructions for writing reports

The report should be well organized, neat, and be written using succinct but effective English. Your grade will depend both on the technical content of and the quality of your work and on the quality of your writing.

The report should address the following points:

<u>Introduction</u> – Put your work in context. Briefly summarize the purpose of the lab with enough detail for a reader outside the class to understand. Explain why the work is relevant. State the objectives. (10 points)

Methods – Briefly describe what you did. Do not give too much detail here unless your work departed from what we have outlined here. Do not repeat what is in the handout. (10 points)

Results – Present tabulated results from each determination as appropriate. If figures are requested or will enhance your report, ensure that they, like the tables, have numbers, titles, labels, and units which can be referred to in your text or which have sufficient detail that they can be understood if they are stand-alone. If generating and presenting your report electronically (which depends on the individual lab instructions) include all calculations and formulae in the spreadsheet cells. In both hardcopy and electronic formats explain the calculations used to generate data in tables and figures. Estimate the precision of your measurements when possible. (30 points)

Discussion – Where requested, calculate the accuracy and precision associated with your measurements describing any documentation, assumptions, or calculation procedures used to make them. Consider the sources of the errors and what could be done to minimize them. Answer the questions specific to the lab assignment. (40 points)

Summary – What are the most important lessons you learned here that might be valuable to others and what are the implications for environmental application? (10 points)

Your report must not exceed five typed pages (except where otherwise stated on the individual lab instructions), including all figures, tables, and appendices.

Reports that exceed the defined page limit are unacceptable and will be returned ungraded.

The report should have a separate cover page that lists your name, the date, and a title.

Schedule

All lab reports are due by 4 pm the following Wednesday unless otherwise indicated by the instructor. Not listed are weeks where no class is held during Fall and Thanksgiving breaks

Date	Type	Topic
Week 1	Lecture	Introductions, Report writing, Objectives, Outcomes
	Lab	Introduction to basic lab skills and use of statistical measurements
Week 2	Lecture	Introduction to experimental design
	Lab	The Scientific Method - no handout
Week 3	Lecture	Soil Properties
	Field trip	Soil collection from hog farm in eastern NC
Week 4	Lecture	Soil nutrients
	Lab	Soil methods including; moisture content, bulk density, particle density, porosity, texture, organic matter content, water holding capacity, and ammonia
Week 5	Lecture	Trace gas fluxes in soils
	Lab	Static chamber methodology
Week 6	Lecture	Indices of microbial activity
	Lab	Denitrifying enzyme activity -nitrous oxide using chromatographic methods
Week 7	Lecture	Introduction to spectroscopy
	Lab	UV-visible spectrophotometry applied to the analysis of air samples NIOSH Method for Formaldehyde - Print and bring to lab
Week 8	Lecture	Source water quality
	Lab	Aggregate measurements of water; turbidity, conductivity, color, solids: Field trip to OWASA

Week 9	Lecture	Chemical equilibria in water
	Lab	Chemical quality of drinking water: pH, titrimetric analysis, acid-base titrations, alkalinity
Week 10	Lecture	Analysis of organics in air
	Lab	Organic vapor sampling with detector and charcoal tubes
Week 11	Lecture	Introduction to chromatography and mass spectrometry
	Lab	Application of GC/MS to analysis of organic vapors
Week 12	Lecture	Measurement of bacterial and viral pathogens in water Class exercise - Print and bring to class
	Lab	Laboratory methods for measurement of pathogens in water
Week 13	Lecture	Aquatic ecosystems
	Field Trip	Integrated Water Systems