

Term: **Spring 2007**

CE 484/584 Experimental Design and Field Sampling

5:00 to 6:15 PM, Monday and Wednesday, 340 H.M. Comer Hall

Instructor: Robert Pitt

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Catalog Description	Experimental design, sensitivity analyses, water sampling, and flow monitoring. Receiving water chemical reactions. Field investigations.
Prerequisites	Intro to Environmental Engineering 320 and Statistical Applications in Civil Engineering CE 573, or permission of instructor.
Corequisites	none
Course Objectives	<p>At the successful completion of this course, the student will be able to effectively design experiments and prepare field or laboratory sampling elements of proposals. In addition, basic statistical analyses (graphical and exploratory) will also be examined.</p> <p>Course Goals: To better understand sources of uncertainty and errors in engineering decision making. To practice project planning within limited resources. To practice calibration of conventional engineering design algorithms. Even though this class is designed for environmental engineering students (with a strong water quality emphasis), the statistical basis for experimentation covered here is very applicable for other disciplines.</p>
Course Website	http://unix.eng.ua.edu/~rpitt/Class/ExperimentalDesignFieldSampling/MainEDFS.html
Required Texts and References	Thomann, R.V. and J.A. Mueller. <i>Principles of Surface Water Quality Modeling and Control</i> (Harper & Row). 1987, plus other material on course website.
Suggested Texts and References	<ul style="list-style-type: none">• Burton, G.A. and R. Pitt. <i>Stormwater Effects Handbook</i>. CRC/Lewis Publishers, New York. 2001 (available from class and from EPA web sites).• Berthouex, P.M. and L.C. Brown. <i>Statistics for Environmental Engineers</i> (Lewis Publishers, 2nd edition). 2002.• Gilbert, R.O. <i>Statistical Methods for Environmental Pollution Monitoring</i> (Van Nostrand Reinhold). 1987
Grading	<p>Expected grading weights (may have minor changes):</p> <ul style="list-style-type: none">• Periodic homework assignments: 15%• Lab and data mini projects: 35%• Final project: 50%

Attendance Policy	Students are expected to attend all lectures. In an absence is unavoidable, the student should contact the instructor before the class meets. Excessive unexcused absences may result in grade reductions.
Homework Policy	Students are expected to submit all homework and other assignments. Missing assignments will likely result in an incomplete grade for the class, unless excused.
Exam/Quiz Policy	Students must participate in and complete the final group project assignment and be present for the final presentation, unless excused.
Policy on Missed or Late Coursework	Late assignments will be subject to lowered grades.
Course Portfolio	<p>The CE program requires every undergraduate student in every class to develop a course outcome portfolio. Through the course portfolio, each student is to demonstrate their achievement of the specific program outcomes addressed in each course (see the “Contribution to Program Student Outcomes” section of this syllabus). Graded work from the course (e.g., graded homework, projects, reports, quizzes, exams, etc.) may be used to illustrate achievement of the outcomes. Several assignments, projects, and/or quiz/exam questions in each course will address specific outcomes. If a student does well in these assignments, they would be suitable examples for inclusion in the B.S. degree portfolio. The portfolios will be collected prior to or during the final exam.</p> <p>The intent of this requirement is to assist students with the development of a well-organized program outcome achievement portfolio required for graduation. The portfolio must be organized with tabs indicating each outcome separately (e.g., T3, T5, T6, and P2). Behind each tab, student work demonstrating command of the respective outcome should be neatly presented. All materials must be three-hole punched, but do not use a three-ring binder. Rather, the portfolio materials must be secured with appropriately sized binder clips. A cover page is required and must include the student’s name, the course number and title, and the term the course was taken.</p>
Portfolio Grading	All undergraduate students are required to prepare a portfolio, as described above. It is to be turned in along with the final project report and will be graded as part of that report. The student must pick up the graded portfolio and retain it for possible use as part of their graduation portfolio.
Academic Misconduct	Any act of dishonesty in any work constitutes academic misconduct. The Academic Misconduct Disciplinary Policy will be followed in the event of academic misconduct and will be handled by the Dean’s office.
Accommodations	Reasonable accommodations are made on an individualized basis. It is the responsibility of persons with disabilities, however, to seek available assistance and make their needs known. The University has designated the Office of Disability Services as the campus coordinating office for the provision and delivery of services and reasonable accommodations that ensure the University's programs, services, and activities are accessible to students with disabilities. The Office of Disability Services is available to assist any student who has a qualified and documented disability. Please contact the Office of Disability Services at 348-4285 for additional information.

<p>Schedule/Topic Outline</p>	<p>This course is divided into 3 main sections. The first course section covers experimental design fundamentals. As an example, how many samples are needed to answer specific answers with predetermined levels of confidence and power? We will address the statistical basis for data collection, and how different sampling strategies are most efficient for specific conditions. Although this information is of most interest to experimenters, anyone who uses data will also benefit from this information. In addition, it is not possible to design effective experiments without understanding how the data will be used. Therefore, we will also review some simple data analysis procedures, such as trend analyses and paired analyses of test and control conditions. This will enable us to illustrate how the experimental effort needs to be adjusted for different anticipated analytical procedures. We will also cover QA/QC procedures that are needed in the field and the laboratory to ensure quality data.</p> <p>The second course section covers a few environmental processes of typical interest, and the type of data needed to calibrate models using these processes. Eutrophication issues (and critical nutrients) are discussed, along with tracer tests, and vertical mixing experiments to measure pollutant movement. These will include the processes that we will utilize during the class projects. We will also cover sampling procedures and techniques for different types of water sampling. The selection of analytical procedures will also be covered, including needed detection limits, sample handling, safety, costs and complexity of analyses.</p> <p>Finally, the class will conduct several final small group projects where the class principles will be used. We will also meet for several extended lab/field sessions on selected weekends for group sampling and experimental training (at local rivers and lakes).</p> <p>The course will have 10 basic modules, plus the small group projects. The modules are:</p> <p>Module 1: Experimental design for monitoring Module 2: Quality control and selection of analytical methods Module 3: Water sample collection methods Module 4: Specialized analytical methods for water Module 5: Statistical analyses Module 6: River modeling – transport Module 7: Lake modeling – stratification and detection Module 8: Microorganism origins and fate Module 9: Dissolved oxygen processes, eutrophication and temperature modeling Module 10: Toxicants</p> <p>The anticipated major class projects will include:</p> <ol style="list-style-type: none"> 1) quality control review of data obtained in the National Stormwater Quality Database (NSQD) (assignment as part of Module 2) 2) automatic sampler programming as part of full-scale UpFlo™ Filter installation (assignment as part of Module 3) 3) the group assignments will involve dividing the class into 3 groups focusing on: <ul style="list-style-type: none"> • Lake Tuscaloosa bacteria fate modeling (an extension of Fall 2004 project) • collection and evaluation of PAHs associated with sediment (part of current NSF research)
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	<ul style="list-style-type: none"> • pilot-scale testing of sediment scour from manhole sumps (part of current scour research) <p>The UpFlo™ Filter tests and NSQD evaluations may also receive additional attention, depending on project timing.</p>
Midterm Exam Date(s)	There is no scheduled midterm exam for this class.
Final Exam Date:	The final project presentations and last day for submitting missing assignments will be Monday, May 7, 2007; 7 to 9:30 pm
Other Course Information	Note: this is a combination classroom and laboratory class. We will have lectures at the designated times on M and W, but several course sessions will be cancelled due to conference and committee trips. However, we will also have a few longer field trips on weekends, of about a half day duration, dates TBD.

Contribution to Program Student Outcomes. Students taking this course will:

Outcome	Description
Outcome T1: <i>(Level 3)</i>	Solve problems in mathematics through differential equations, probability and statistics, calculus-based physics, and general chemistry. Most of the class assignments and projects will involve mathematical, statistical, and scientific tools. (level 3).
Outcome T2: <i>(Level 4)</i>	Select and conduct civil engineering experiments to meet a need, and analyze and evaluate the resulting data. Students will determine which experiments to conduct and will analyze and interpret the data to meet the needs of the modeling and design activities. (level 4)
Outcome T3: <i>(Level 3)</i>	Apply relevant knowledge, techniques, skills, and modern engineering tools to identify, formulate, and solve engineering problems, including problems in at least four technical areas appropriate to civil engineering. Environmental engineering skills and tools are used to solve project problems. (level 3)
Outcome T5: <i>(Level 3)</i>	Predict possible global, economic, environmental, and societal impacts of a specific, relatively constrained engineering solution. The class project typically involves a local problem that addresses technical and social issues. The tools and evaluations are used to predict the possible solutions or outcomes. (level 2)
Outcome T6: <i>(Level 3)</i>	Function effectively as a member of a multidisciplinary team. The class projects are conducted by teams of students. (level 3).

Outcome T7: <i>(Level 1)</i>	Define key aspects of at least one traditional or emerging area of advanced specialization within the context of civil engineering. Being an advanced elective, students are introduced to key aspects of environmental engineering. (level 1)
Outcome P1: <i>(Level 4)</i>	Analyze a situation involving multiple conflicting professional and ethical interests, to determine an appropriate course of action. One of the main purposes of the experimental design parts of the class is to balance needs and costs. (level 3)
Outcome P2: <i>(Level 4)</i>	Organize and deliver effective written, verbal, graphical and virtual communications. The class project results in an organized and complete report. Several presentations are also made during the class. (level 4)
Outcome P3: <i>(Level 3)</i>	Demonstrate the ability to learn through independent study, without the aid of formal instruction. The class project requires independent study. (level 3).