**CE 378 Water Resources Engineering**

Term: Spring 06

CE 378 Water Resources Engineering (4). Four hours, including laboratory
12:30 to 1:50 M and W, room 342 H.M. Comer

**Instructor:** Robert E. Pitt

**Lab instructor and grader:** Aaron Quick

**Office:** 347 MIB

**Office Hours:** M and W 2:30 to 3:30, when in town, or by appointment; by email anytime

**Phone:** (205) 348-2684
**e-mail:** rpitt@eng.ua.edu

Located at: http://unix.eng.ua.edu/~rpitt/Class/Classes.shtml

**Required Texts and References**


---

### Catalog Description
Mechanics of steady and unsteady flow in closed and open conduits, hydrology; water supply and wastewater disposal.

### Prerequisites
AEM 311 (Fluid Mechanics)

### Co requisites
none

### Course Objectives
This course is directed to applications of fluid mechanics, hydrology, and hydraulics as they apply to the discipline of water resources engineering. Topics covered include flow in closed conduits and open channels, hydraulic machinery (pumps), and surface water hydrology and statistical methods. Student projects will be directed to simple designs of urban water-use and water-control systems.

At the successful completion of this course, the student will be able to:

- Design and evaluate water distribution systems
- Design and evaluate wastewater collection system
- Design and evaluate stormwater drainage system
- Have experience with current design software for the above systems
- Understand the theoretical basis for water resources systems and how these are implemented in practice.

### Course Website
Located at: [http://unix.eng.ua.edu/~rpitt/Class/Classes.shtml](http://unix.eng.ua.edu/~rpitt/Class/Classes.shtml)
Suggested Texts and References


The advanced edition is available on-line at:  

This book is also available on-line at:  

Software:

EPANet 2.0 (US EPA) water distribution system design and analysis software  
[http://www.epa.gov/ORD/NRMRL/wwrd/epanet.html](http://www.epa.gov/ORD/NRMRL/wwrd/epanet.html)

WinTR-55 1.0.08 (USDA) hydrology software  

SWMM5.00.006a (US EPA) storm drainage and sanitary sewerage system design and analysis software  

Grading

The final grade assigned for this course will be based on the following distribution, subject to slight modifications:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework, paper, and quizzes</td>
<td>25 %</td>
</tr>
<tr>
<td>Projects</td>
<td>30 %</td>
</tr>
<tr>
<td>Laboratory write-ups</td>
<td>25%</td>
</tr>
<tr>
<td>Final integrated exam and presentation</td>
<td>20 %</td>
</tr>
<tr>
<td>Class notebook</td>
<td>Not graded</td>
</tr>
</tbody>
</table>

3 term projects will be due during the term:

- water supply system design
- sanitary sewer design
- storm sewer system design

If any of the major assignments are not turned in, the student will receive an incomplete for the course.

Attendance Policy

Students are expected to attend all lectures. If an absence is unavoidable, the student should contact the instructor before the class meeting. Excessive unexcused absences may result in grade reductions. The student is expected to be in class and seated at the beginning of the course period.
<table>
<thead>
<tr>
<th><strong>Homework Policy</strong></th>
<th>Homework and project assignments will be due on the dates announced in class. Homework turned in up to 2 days late will be assessed an automatic penalty of 20 percent. Homework submitted more that 2 days late will not be accepted. Missed assignments or quizzes will not be able to be made up unless prior arrangements have been made with the instructor, or in the case of a documented emergency.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Exam/Quiz Policy</strong></td>
<td>The exams will consist of take-home project assignments. Students will work individually, as they will have different design objectives and locations.</td>
</tr>
</tbody>
</table>
| **Other Course Policies** | **Computer Use Requirement:**
This course has a "C" designation and hence will partially fulfill core curriculum requirements established by The University of Alabama. Water resources engineering is a field in which solutions to problems are very often multi-valued rather than singly-valued. For example, solutions can consist of an entire vector or matrix of values, or they can be x-y graphs showing the relationship between two variables. Computer software, and particularly spreadsheets such as Microsoft’s Excel product, is very well suited to developing tabular and graphical solutions to problems of the types encountered in this course. Students are required to employ software in the completion of homework assignments. Failure to do so on any particular assignment will result in an automatic 20 percent grade reduction for that assignment. Failure to use computers on a recurring basis will result in a non-passing grade for the course. |
| **Course Notebook** | The CE program requires every student in every class to develop a separate, three-ring binder of course notes, handouts, homework, quizzes, and exams. The notebooks will be collected and examined prior to, or during, the final presentations during the final exam period. The intent of this requirement is to provide every CE student with a well organized library of reference material that they can use in their professional career. The instructor of each course may also make a copy of the notebooks for review of the course by a faculty committee.

The following material (if applicable) with tabs should be included: notes (with daily handouts integrated into notes); reference handouts; homework assignments; lab assignments and reports; quizzes; exams; and projects

At the end of the course the student should number the notebook pages and add an index page. The binder itself should have the course name on the spine and on the cover. |
<p>| <strong>Notebook Grading</strong> | The notebook will not be graded, but it must be submitted for review for completion. An incomplete will be assigned if no notebook is submitted. The notebooks will be returned at the end of the term when the final exams are returned, usually in a suitable container outside of the instructor’s office door. If the notebook is not collected within a month of the start of the following term, they will be discarded. |
| <strong>Academic Misconduct</strong> | 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. |</p>
<table>
<thead>
<tr>
<th><strong>Accommodations</strong></th>
<th>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.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Schedule/Topic Outline</strong></td>
<td>Topics that will be addressed during this course will include the following. Also shown are the general text pages for the topics. Numerous supplemental handouts and Internet references will also be used. Durations shown are approximate and may be adjusted as the semester progresses. The class numbers shown are for traditional 50 minute classes.</td>
</tr>
<tr>
<td><strong>Introduction</strong></td>
<td>1 class</td>
</tr>
<tr>
<td><strong>Review of conservation principles (pgs 35 – 53)</strong></td>
<td>1 class</td>
</tr>
<tr>
<td><strong>Flow in closed conduits</strong></td>
<td>2 classes</td>
</tr>
<tr>
<td>Single pipes (pgs. 65 – 83)</td>
<td>3 classes</td>
</tr>
<tr>
<td>Pipe networks (pgs 93 – 101)</td>
<td>4 classes</td>
</tr>
<tr>
<td>Water use and water distribution system design (pgs 116 – 133)</td>
<td>2 classes</td>
</tr>
<tr>
<td><strong>Pump performance and selection (pgs 101 – 116)</strong></td>
<td>2 classes</td>
</tr>
<tr>
<td><strong>Flow in open channels</strong></td>
<td>3 classes</td>
</tr>
<tr>
<td>Fundamental principles (pgs 138 – 204)</td>
<td>4 classes</td>
</tr>
<tr>
<td>Channel design methods (pgs 204 – 223)</td>
<td>4 classes</td>
</tr>
<tr>
<td>Design of sanitary sewers (pgs 224 – 242)</td>
<td>2 classes</td>
</tr>
<tr>
<td><strong>Probability and statistical methods (pgs 258 – 295)</strong></td>
<td>3 classes</td>
</tr>
<tr>
<td>Surface water hydrology</td>
<td>4 classes</td>
</tr>
<tr>
<td>Design storms and IDF curves (pgs 298 – 323)</td>
<td>3 classes</td>
</tr>
<tr>
<td>Rainfall abstractions (pgs 323 – 359)</td>
<td>4 classes</td>
</tr>
<tr>
<td>Peak flow estimation (pgs 359 – 365)</td>
<td>3 classes</td>
</tr>
<tr>
<td>Hydrographs and flow routing (pgs 365 – 396)</td>
<td>4 classes</td>
</tr>
<tr>
<td>Design of storm sewer systems (pgs 400 – 415)</td>
<td>3 classes</td>
</tr>
<tr>
<td>Culvert design (pgs 196 – 204)</td>
<td>3 classes</td>
</tr>
<tr>
<td>Adobe Acrobat pdf versions of the course overheads and supplementary material are available from the course website, located at: <a href="http://unix.eng.ua.edu/~rpitt/Class/Classes.shtml">http://unix.eng.ua.edu/~rpitt/Class/Classes.shtml</a>. Students can print out copies of this material from the website.</td>
<td></td>
</tr>
<tr>
<td>The schedule for the laboratory exercises will be handed out at the first laboratory session.</td>
<td></td>
</tr>
<tr>
<td><strong>Midterm Exam Date(s)</strong></td>
<td>The interim major assignment due dates will be announced in class with sufficient time for completion.</td>
</tr>
</tbody>
</table>
| **Final Exam Date:** | **First lab class:** January 17, 2006  
**Class holiday (MLK day):** January 16, 2006  
**Spring break:** March 17 – 24 (no classes on March 20, 21, or 22)  
**Last day of class:** May 3, 2006  
**Final exam:** May 8, 2006, 11:30 to 2 pm |
<table>
<thead>
<tr>
<th>Homework Format</th>
<th>The homework will be submitted in a professional and complete style. Almost all problems will require a necessary neat sketch. Grades will be reduced for poor organization and inappropriate use of significant figures. See the note on computer use for this class.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other Course Information</td>
<td>A plus/minus grading system will be in effect for undergraduate students.</td>
</tr>
</tbody>
</table>
CE 378 Class Outcomes

Contribution to Outcomes

As required for the accreditation of our BSCE program, the Civil, Construction, and Environmental Engineering Program at The University of Alabama, in full consultation with its various constituencies, including alumni and employers, has established the following overarching student outcomes. These outcomes describe what students are expected to know or be able to do by the time of graduation from our program. At a minimum, the outcomes that have been checked will be addressed specifically and directly in this course. Other outcomes may be addressed to a lesser extent.

Graduates must demonstrate an understanding and reasonable compliance with the following as they apply to Civil Engineering:

- X An ability to apply knowledge of mathematics (through differential equations and probability/statistics), science (including physics and chemistry), and engineering.
- ☐ An ability to function on multidisciplinary teams.
- X An ability to identify, formulate, and solve engineering problems.
- X An understanding of professional and ethical responsibility.
- X An ability to effectively communicate by speaking.
- X An ability to effectively communicate by writing.
- X A knowledge of contemporary issues.
- X An ability to design and conduct experiments, as well as analyze and interpret data.

- X Graduates will be capable of performing civil engineering design to meet desired needs.

Graduates will understand civil engineering professional practice issues such as:

- ☐ Procurement of work and the interaction of design & construction professionals.
- X The impact of civil engineering solutions in a global and societal context.
- ☐ The importance of professional licensure, lifelong learning, and continuing education.

Graduates will have proficiency in at least four of the following areas:

- X Environmental Engineering
- ☐ Structural Engineering
- ☐ Geotechnical Engineering
- X Water Resources Engineering
- ☐ Transportation Engineering
CE 378 Outcomes Statement
The following are the stated outcome goals, and how we address them, for CE 378, Water Resources Engineering:

• An ability to apply knowledge of mathematics (through differential equations and probability/statistics), science (including physics and chemistry), and engineering.

This is a fundamental aspect of most assignments and class topics. This class starts with a review of fluid mechanics and hydraulics, and then moves into new material.

• An ability to identify, formulate, and solve engineering problems.

Again, the class assignments, especially the major design projects, require the students to formulate and solve technical engineering problems, including gathering necessary data.

• An understanding of professional and ethical responsibility.

Design standards and service requirements for public utilities are discussed for water supply and drainage. In addition, short-comings of commonly used design approaches are also discussed. Forensic engineering experiences, including the preparation of ordinances, consulting, and expert witnessing are discussed periodically during the class.

• An ability to effectively communicate by writing.

There are writing assignments during the class, specifically the stream classification and stability assignment that requires the students to go into the field on their own and conduct this assessment and prepare a written report.

• A knowledge of contemporary issues.

The initial lecture covers a historical perspective of urban water issues, leading to current issues, including inadequate water supplies, water conservation, and water reuse. We aren’t able to address these quantitatively in this class (we do in the Urban Water class), but they are discussed when we cover utility designs.

• Graduates will be capable of performing civil engineering design to meet desired needs.

An important activity of this class involves three major design projects covering water supply, sanitary sewerage, and storm drainage. During these design projects, we utilize current design models that are commonly used in industry.

• The impact of civil engineering solutions in a global and societal context.

The topic of water resources cannot be taken in isolation. Global and societal issues are discussed during the water supply and water consumption units, for example.

• Environmental and Water Resources Engineering

Obviously, this class focuses on numerous environmental engineering and water resources engineering topics. All class modules address these engineering fields.