CE 378 Water Resources Engineering

Term: Spring 2013
CE 378 Water Resources Engineering (3). Three hours
1:00 to 1:50 M, W and F, room 254 Hardaway Hall

Instructor: Robert E. Pitt, Ph.D., P.E., BCEE, D. WRE
Office: 1005A Bevill
Office Hours: M and W 3 to 4 pm; when in town, or by appointment; by email anytime
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TA: Redahegn Sileshi (redahegnkas@yahoo.com)

<table>
<thead>
<tr>
<th>Catalog Description</th>
<th>Mechanics of steady and unsteady flow in closed and open conduits, hydrology; water supply and wastewater disposal.</th>
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</thead>
<tbody>
<tr>
<td>Prerequisites</td>
<td>Dynamics (AEM 264) and Fluid Mechanics (AEM 311); or Fluid Flow Operations (ChE 304)</td>
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<tr>
<td>Co requisites</td>
<td>none</td>
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<td>Course Objectives</td>
<td>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 sustainable urban water-use and water-control systems. At the successful completion of this course, the student will be able to apply the fundamental principles of conservation of mass, momentum and energy to the practical solution of both analysis and design problems in closed and open conduit flows, and will understand the performance characteristics of pumps. The student will also be introduced to hydrology and to methods of quantification of hydrologic uncertainty.</td>
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<td>Course Website</td>
<td>Located at: <a href="http://unix.eng.ua.edu/~rpitt/Class/Water%20Resources%20Engineering/WREMainPage.htm">http://unix.eng.ua.edu/~rpitt/Class/Water%20Resources%20Engineering/WREMainPage.htm</a></td>
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<td>Required Texts and References</td>
<td>There are no required texts for the class, as much of the reference material is readily available from several sources, including the class website noted above. If you are interested in further study, or to specialize, in this field, then acquiring one of the standard reference textbooks noted below is strongly encouraged.</td>
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| Suggested Texts and References | Standard reference textbooks recommended (most recent editions noted, but prior edition likely suitable if more readily available):
  • Chin, D.A., Water Resources Engineering, Prentice Hall. 2012, 3rd edition. 960 pages (addresses all of the major course topics, but only briefly discusses sanitary sewerage design).
  • Mays, L.W., Water Resources Engineering, John Wiley & Sons. 2010, 2nd edition. 890 pages (doesn’t cover sanitary sewerage design, but does a more through presentation of the other course topics).

Internet reference material:
Software:
EPANet 2.00.12 (US EPA) water distribution system design and analysis software (May 27, 2008 most recent version for Windows).
http://www.epa.gov/nrmrl/wswrd/dw/epanet.html

WinTR-55 1.0.22 (USDA) hydrology software (August 5, 2009 most recent version).
http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/water/?&cid=stelprdb1042901

SWMM5.00.021 (US EPA) storm drainage and sanitary sewerage system design and analysis software (April 21, 2011 most recent version).
http://www.epa.gov/nrmrl/wswrd/wq/models/swmm/

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

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<thead>
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<th>Individual homework</th>
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<tr>
<td>Team projects</td>
<td>80% (including self/team evaluations)</td>
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<tr>
<td>Final class portfolio</td>
<td>10%</td>
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If you complete an assignment as given, and it is correct and presented in a professional manner, you will have done what is expected and will receive an “above average” (B) grade. You will receive an “excellent” (A) grade only for work of an outstanding caliber.

3 major team 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. The teams will be selected well before the first team design assignment is due.

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.

Homework Policy
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 than 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.

All homework will be electronically submitted to the course TA who will conduct the initial assignment grading. Excellent examples of course work may be posted on the class website as examples for future students. Team project assignments will also be submitted by hard copies (along with electronic submissions).

Exam/Quiz
The exams will consist of take-home project assignments. Student teams will work by
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<th>Policy</th>
<th>themselves, as they will have different design objectives and locations. There will be an FE-style mini exam in class given near the start of the course.</th>
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| 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 single-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, 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 and design 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.  

All design project assignments are required to be typed using a word processor, with extensive use of the “equation editor” and computer generated tables and graphs. Photographs from digital cameras, or scanned prints, may also be needed for some assignments. Scanned photos or field sheets should be saved as reduced size jogs (200 dpi is suitable) to reduce the total file size of the resulting document.  

**Cell Phones and Other Electronic Devices in Class:**  
The operation of cell phones or other personal messaging equipment will not be permitted in class, except for emergencies. Devices can be used during class for taking notes or following lectures. |
| **Course Portfolio** | The Department requires every 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 projects and other work.) may be used to illustrate achievement of the outcomes. Several assignments in the course will address specific outcomes. If a student does well in these assignments, they would be suitable examples for inclusion in the graduation portfolio. The portfolios will be turned in to the instructor at the last class period and will be handed back on the date of the final exam. 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, a summary of how the attached assignments meet the outcome, along with the 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. |
| **Portfolio Grading** | The portfolio grade is approximately 10% of the total course grade. If the portfolio is not submitted (or incomplete), the student will receive an incomplete for the class. The class will be submitted electronically to the course grader. |
| **Academic Misconduct** | Any act of dishonesty in any work constitutes academic misconduct. The university Academic Misconduct Disciplinary Policy will be followed in the event of academic misconduct and will be handled by the Dean’s office. |
| **Accommodation** | 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.

| Schedule/Topic Outline | Topics that will be addressed during this course will include the following. Also shown are the general text pages for the topics in Chin (2nd edition). Numerous supplemental handouts and Internet references will also be used. Durations shown are approximate and may be adjusted as the semester progresses. In addition, a few review modules are also included on the class website that will not be covered in class, but are available for the student’s independent review and use.

There are a total of about 42 class sessions scheduled for the term (schedule shown subject to adjustment):

**Introduction (Chin pgs 1 - 9)**
- **Module 1:** Historical Urban Water Systems

**Flow in Closed Conduits (Chin pgs 10 – 40)**
- **Module 3a:** Continuity, Momentum and Energy (Bernoulli)
- **Module 3b:** Darcy Weisbach
- **Module 3c:** Hazen Williams
- **Module 3d:** Manning
- **Module 3e:** Comparison of methods

**Pipe Networks (Chin pgs 40 – 48; 64-89)**
- Demonstration of pipe network flow in hydraulics lab (after class hours period)
- **Module 4a:** Water demand
- **Module 4b:** Water distribution system design
- **Module 4c:** EPANET2 computer lab demonstration for design problem

**Pump performance and selection (Chin 48 - 64)**
- **Module 5:** Pumps and storage

**Flow in open channels (Chin 97 – 127; 127 – 145; 202 - 231)**
- Demonstration of open channel flow in hydraulics lab (after class hours period)
- **Module 6a:** Manning’s specific energy
- **Module 6b:** Water surface profiles
- **Module 6c:** Design for stable open channels
- **Module 6e:** Stream buffers and land development

**Design of sanitary sewers (Chin pgs 231 - 255)**
- **Module 7:** Sanitary sewer design

**Probability and statistical methods (Chin pgs 271 - 328)**
- **Module 8:** Probability and statistical methods
Module 8: Probability and statistics

Surface water hydrology (Chin pgs 334 - 424) 10 classes
Module 9a: Rainfall and runoff introduction
Module 9b: Runoff calculations with WinTR55
Module 9c1: WinTR55 demonstration in computer lab for design problem
Module 9c2: WinTR55 ponds document
Module 9d: Detention pond design with routing

Design of storm sewer systems (Chin pgs 479 - 541) 4 classes
Module 10a: Storm sewer system design
Module 10b: Gutters and inlet design
Module 10c: Getting started with SWMM5 storm and sanitary demonstration in computer lab for design problems
Module 10d: Sediment movement in sewers

Culvert design (Chin pgs 185 - 202) 3 classes
Module 11: Culvert hydraulics

Adobe Acrobat pdf versions of the course PowerPoint presentations and supplementary material are available from the course website, located at: http://unix.eng.ua.edu/~rpitt/Class/Water%20Resources%20Engineering/WREMainPage.htm. Students can print out copies of these materials from the website.

The anticipated schedule for the computer lab sessions will be announced.

Midterm Exam Date(s) The major assignment due dates will be announced in class with sufficient time for completion.

Final Exam Date: First class: January 9, 2013
Class holiday (MLK day): January 21, 2013
Spring break: March 22 through 29, 2013
Honor’s day holiday: April 5, 2013
Last day of class: April 26, 2013
Final exam: May 2, 2013; 11:30 am to 2 pm (last project due date and portfolio review)

Homework Format Homework will be submitted in a professional and complete style. Almost all problems will require neatly sketched figures. Grades will be reduced for poor organization and inappropriate use of significant figures. See note on computer use for this class. All assignments will be electronically submitted to the course grader. Make sure the file name for your assignments includes your last name and assignment name. You will need to set up free DropBox accounts with the grader to submit the assignments (he will instruct you how to do this).

Other Course Information A plus/minus grading system will be in effect for undergraduate students.

Contribution to Program Student Outcomes
As required for the accreditation of our BSCE and BSConE programs the following student learning outcomes have been established. These outcomes describe what students are expected to know or be able to do at the time of graduation. At a minimum, the outcomes that have been checked below will be fully or partially addressed, perhaps at a lower level, in a significant and direct manner in this course. Other outcomes may be addressed to a lesser extent. See the following departmental discussion for more details on student outcomes: [http://cce.eng.ua.edu/undergraduate/program-objectives-and-student-learning-outcomes/](http://cce.eng.ua.edu/undergraduate/program-objectives-and-student-learning-outcomes/)

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<thead>
<tr>
<th>Outcome</th>
<th>Level</th>
<th>Description</th>
<th>Details</th>
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</thead>
<tbody>
<tr>
<td>Outcome F1: (Level 3) This class Level 3</td>
<td>Solve</td>
<td>Solve problems in mathematics through differential equations, probability and statistics, calculus-based physics, general chemistry, and one additional area of science. The course assignments, quizzes and exams utilize mathematical and scientific skills and tools.</td>
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<td>Outcome T1: (Level 4) This class Level 3</td>
<td>Apply</td>
<td>Apply material science, mechanics of solids, and mechanics of fluids. Fluid flow in pipes and channels and design of these systems uses fundamentals of fluid mechanics.</td>
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<td>Outcome T3: (Level 3) This class Level 3</td>
<td>Apply</td>
<td>Apply relevant knowledge, techniques, skills, and modern engineering tools to identify, formulate, and solve engineering problems, including BSCE – problems in at least four technical areas appropriate to civil engineering or BSConE – problems in construction processes, communications, methods, materials, systems, equipment, planning, scheduling, safety, economics, accounting, cost analysis and control, decision analysis, and optimization. This class applies relevant knowledge in water resources engineering to actual design problems. The construction process and planning/scheduling considerations are also important aspects of the class design problems.</td>
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<tr>
<td>Outcome T6: (Level 5) This class Level 5</td>
<td>Design</td>
<td>Design a system or process in more than one program-relevant civil or construction engineering specialty field to meet desired needs, within realistic constraints such as economic, environmental, social, political, ethical, health and safety, constructability, and sustainability. Students in this course perform and document (through formal reports) designs of water supply networks, sanitary and storm sewer systems, and culverts.</td>
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<tr>
<td>Outcome P2: (Level 4) This class Level 4</td>
<td>Organize and deliver</td>
<td>Organize and deliver effective written, verbal, graphical and virtual communications. Formal design reports are written by the students in this class for each of the major assignments. These reports are written and use graphical presentations.</td>
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<td>Outcome P3: (Level 3) This class Level 3</td>
<td>Demonstrate</td>
<td>Demonstrate the ability to learn through independent study, without the aid of formal instruction. Certain design problems will require the student to collect needed information to supplement the assignment. In addition, the advanced design assignments will require independent study beyond the formally presented class material.</td>
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