CVEN 458 – "HYDRAULIC ENGINEERING OF WATER DISTRIBUTION SYSTEMS"

SPRING SEMESTER 2016

TEXAS A&M UNIVERSITY
ZACHRY DEPARTMENT OF CIVIL ENGINEERING

Instructor:
Kelly Brumbelow, Ph.D., P.E., ENV SP
Room 139-B, Civil Engineering Building
kbrumbelow@civil.tamu.edu
(979) 845-7436

Office Hours: To be decided by class vote. See online poll at http://doodle.com/poll/53bz3yphbvgfr7nr.

Lectures: MWF 1:50 – 2:40 PM; Room 421, Civil Lab Building (CVLB)

Texts: The primary "textbook" for the class will be lecture notes and selected handouts distributed via the class website and eCampus. I will recommend a few books as worth investigating for review, reference, and/or additional study; some of these are available online free-of-charge through the TAMU Libraries – search for the Knovel database.

1. Savic, D.A., and J.K. Banyard. *Water Distribution Systems.* ICE Publishing, London, UK, 2011. ISBN: 978-0-7277-4112-7. *{Available in Knovel database}* This book is very recently available online, so I'm still familiarizing myself with it, but it appears to be quite good with a nice blend of theory and application.
2. Walski, T.M., et al. *Advanced Water Distribution Modeling and Management,* Bentley Institute Press, Exton, Penn., 2007. ISBN 978-1-934493-01-4. *{Available in Knovel database}* This book is very readable and emphasizes application and practical issues, but does not include extensive theory.
3. Mays, L.W. (ed.), *Water Distribution Systems Handbook,* McGraw-Hill, New York, 2000. ISBN: 0-07-134213-3. This book was previously available in the Knovel database and was used as the course textbook. However, the publisher seems to have revoked/ended the license, and you will now need to purchase it or borrow it from a library. It is comprehensive on WDS issues and emphasizes theoretical content. It is somewhat uneven on applications.
4. Wurbs, R.W, and W.P. James. *Water Resources Engineering.* Prentice-Hall, Upper Saddle River, NJ, 2002. The old A&M standby on water engineering topics. A decent reference to review topics for this class, but we will go much deeper into most topics.

Course Description: *From the TAMU Undergraduate Catalog:* "Pressure conduit hydraulics; design, modeling, and analysis of water conveyance and distribution systems including pipelines, pipe networks, and pumps. Prerequisite: CVEN 339 or approval of instructor."

Learning Outcomes: After completing this course students should be able to…

(1) Formulate solutions to pipe network problems including pumps, fixed-head nodes, and nodal demands and calculate solutions using a variety of techniques;

(2) Explain the use of elements such as flow-control, pressure-control, air relief, and isolation valves, hydrants, meters, storage facilities, booster stations, and pressure planes and include these elements in system solutions;
(3) Use EPANet software to analyze a variety of water distribution system problems including single-period and extended period simulation, flow tracing, fire flow evaluation, demand and pressure criteria, and storage needs evaluation;
(4) Properly calibrate an EPANet hydraulic model given measured system data;
(5) Analyze pumping systems for a variety of conditions including pumps in parallel and series, unbalanced pump combinations, and net positive suction head problems;
(6) Solve basic problems of unsteady flow in pressure conduits including water hammer phenomena;
(7) Solve basic water quality problems in water distribution systems and storage facilities;
(8) Explain issues related to typical operations, maintenance, repair, and rehabilitation of water distribution systems;
(9) Perform basic vulnerability analysis for a water distribution system and suggest mitigation strategies;
(10) Design a small water distribution system to meet given parameters for water source supply, demands, applicable codes and regulations, operational concerns, and potential future expansion;
(11) Know the academic and professional steps available to pursue a career in water resources engineering after completion of this course.

In addition to these course-specific outcomes, the course will advance your level of attainment for the following ASCE Body of Knowledge 2 outcomes:

- Outcome 1: Mathematics. *Demonstration-level.*
- Outcome 2: Natural Sciences. *Demonstration-level.*
- Outcome 8: Problem Recognition. *Demonstration-level.*
- Outcome 9: Design. *Demonstration-level.*
- Outcome 10: Sustainability. *Demonstration-level.*
- Outcome 11: Contemporary Issues and Historical Perspectives. *Reinforcement-level.*
- Outcome 12: Risk and/or Uncertainty. *Demonstration-level.*
- Outcome 15: Technical Specialization. *Demonstration-level*
- Outcome 16: Communication. *Reinforcement-level.*
- Outcome 17: Public Policy. *Demonstration-level*
- Outcome 21: Teamwork. *Demonstration-level*
- Outcome 24: Professional and ethical responsibility. *Demonstration-level*

Grading:		
	Homework	20%
	Exam 1	25%
	Exam 2	25%
	Term Project	30%

Final letter grades will use the standard 10 point scale (A = 90-100, B = 80-89, etc.) as a starting point. Letter grade ranges may be extended to lower numerical values at the instructor's discretion.

There will be several Homework assignments throughout the semester. Homework assignments will be graded in two parts. About 80% (e.g., 8 out of 10 problems) of each assignment will be graded based on effort alone; you will receive full credit for simply making a reasonable attempt to solve the problem whether or not your answer is correct. You are free to work with others on those problems. The

remainder of each assignment will be graded for accuracy of the solution. You *must* work these problems *individually*. Homework will be submitted and graded using eCampus. If you are not familiar with that system and/or how to scan documents as pdf files for submission, please familiarize yourself immediately. Late homework will not be accepted without a university authorized excuse.

Exams will be traditional written exams completed individually. A variety of formats including closed and open book, etc., may be used. Exact format of exams will be announced ahead of time. Absence from exams will be dealt with according to TAMU Student Rules (see *http://student-rules.tamu.edu/rules7.htm*).

The project will be done in groups. I will provide full guidelines on project requirements later in the semester. The project will require you to bring together all the techniques and knowledge on hydraulic engineering that you have learned up to that point as well as give you experience in using the various software tools. Each group will prepare both written reports and oral presentations of the project results. The projects will be presented during the class's regularly scheduled final exam period (Monday, May 9, 3:30-5:30 PM).

Course Websites: I am in the process of transitioning to use of eCampus, but we will use it as well as my old class site at *http://ceprofs.tamu.edu/kbrumbelow/CVEN458/CVEN458_HE_Brumbelow.htm*. Please pay attention in class to where items will be posted.

Important Dates: Below are important tentative and firm dates for the course this semester. Dates for midterm exams will be determined by class discussion and vote a few weeks ahead of time. If you have a pre-scheduled issue around any of these dates, please let me know in advance.

- Midterm Exam #1 – Friday, March 4 (tentative)
- Term Project Assigned – Friday, March 25 (tentative)
- Midterm Exam #2 – Wednesday, April 27 (tentative)
- Term Project Due – Monday, May 9, 3:30-5:30 PM (Final exam period, firm)

Course Topics:

- Pipe network hydraulics and analysis
- Hydraulic appliances
- Water distribution system design
- EPANet software
- Pump systems
- Unsteady flow
- Water quality in WDS
- Operations, maintenance, repair, and rehabilitation
- Codes and standards
- Vulnerability analysis

Student Rules: TAMU Student Rules are posted at *http://student-rules.tamu.edu*. You should be familiar with these by now. Any issue not addressed explicitly in this syllabus will be governed by the Student Rules.

Absences: TAMU policies regarding student attendance/absences are defined in Part I, Section 7 of the TAMU Student Rules. In addition to those rules, the following policies will apply in this course:

- I do not check attendance as a part of regular course grading – no one will be penalized just for missing class. However, I reserve complete discretion to award bonus points for attendance. Absence or tardiness (even with an excuse) will disqualify a student for such bonus points. My decision on any such bonus points is final. Please do not argue with me over these points.
- I do not require an excuse for an absence on a day when no graded assignment was due or exam was given.
- To excuse an absence that falls under rule 7.1.6 (Injury or Illness that is too severe or contagious for the student to attend class), I will require a medical confirmation note completed by a healthcare provider with a contact phone number no matter how long the student is out of class.
- If a student knows ahead of time that they will be absent from class on a homework due date, they are allowed to have another person submit their assignment on the due date. This is encouraged but not required. A student can also turn in an assignment early.
- Attendance is required of all students for the term project presentations.

Official Notices

ADA Statement: The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services at (979) 845-1637. For additional information visit http://disability.tamu.edu.

Academic Integrity Statement: "An Aggie does not lie, cheat, or steal or tolerate those who do." Upon accepting admission to Texas A&M University, a student immediately assumes a commitment to uphold the Honor Code, to accept responsibility for learning, and to follow the philosophy and rules of the Honor System. Students will be required to state their commitment on examinations, research papers, and other academic work. Ignorance of the rules does not exclude any member of the TAMU community from the requirements or the processes of the Honor System. For additional information please visit: http://www.tamu.edu/aggiehonor/

Students are expected to understand and abide by the Aggie Honor Code presented on the web at: http://www.tamu.edu/aggiehonor No form of scholastic misconduct will be tolerated. Academic misconduct includes cheating, fabrication, falsification, multiple submissions, plagiarism, complicity, etc. These are more fully defined in the above web site. Violations will be handled in accordance with the Aggie Honor System Process described on the web site.

The handouts used in this course are copyrighted. By "handouts," I mean all materials generated for this class, which include but at not limited to syllabi, notes, quizzes, exams, in-class materials, review sheets, and additional problem sets. Because these materials are copyrighted, you do not have the right to copy the handouts unless I expressly grant permission.

Cheating on quizzes and exams will not be tolerated. Cheating will be reported and handled in accordance with the Aggie Honor System Process. Some or all examinations will be closed book; "looking at another student's examination or using external aids (for example, books, notes, calculators, conversation with others, or electronic devices)" during these examinations is a violation of Texas A&M Aggie Honor Code, Cheating, unless specifically allowed in advance by the instructor.

Unless specifically allowed in advance by the instructor, all assignments and homework in this class are expected to be completed based on individual effort. Copying the work of others, including homework, is a violation of Texas A&M Aggie Honor Code, Cheating.