CE 351 Water Resources Engineering, Spring 2014

Instructor

Dr. David Brandes, Associate Professor of Civil & Environmental Engineering
E-mail: brandesd@lafayette.edu Office: AEC 320
Office Hours: M2:00-4:30, W2:00-3:30, Th11:00-12:00
(Note: committee meetings may sometimes overlap with these hours – I will do my best to notify you if this is the case. For example dept meetings are at 4:10 on the first Mon of each month)

When & Where We Meet

Class: MWF 11:00 - 11:50, AEC 327
Lab: Thurs 8:00-10:50, 1:10-4:00, 4:00-7:00 AEC 101 (Hydraulics Lab)

Course Overview

CE 351 is one of the seven required lab courses in our Civil & Environmental Engineering program. Water resources engineering involves the analysis and design of systems that control the quantity and quality of water to meet the needs of humans and the environment upon which we depend. Water resources engineering is based on both hydraulics (e.g. fluid mechanics) and hydrology, and a bit of statistics and probability related to the concept of risk (e.g., the "100-yr flood") that is central to water resources design. The course is divided into three main sections: Pipe Systems, Open Channel Flow, and Hydrology & Sustainable Stormwater Management. Weekly laboratories will include lab experiments in hydraulics, field work, computer analysis, and two field trips. The broad objectives of the course are for you to develop a working knowledge of water resources engineering by applying principles of fluid mechanics, hydrology, and modern engineering tools to analyze and/or design pipe systems, hydraulic structures, and stormwater management systems, and to have an appreciation for how sustainability and climate change relate to water resources engineering.

Text

Mays, L.W. 2011. *Water Resources Engineering*. 2nd Edition, John Wiley & Sons.
This is a comprehensive 890-page book covering far more than one semester's worth of material! You are expected to read the assigned sections of the text to gain additional insight into the topics that are covered in class, and if your curiosity takes you to other parts of the text, so much the better.

Course Webpage and Folder

Webpage: http://sites.lafayette.edu/brandesd/courses/ce-351/
Folder: shared\\cee-drive\CE351 (will be used extensively to share files and lab data)

Specific Course Outcomes *(3e, 3k etc refer to ABET student outcomes)*

- Students will apply the energy equation with frictional and local losses to solve for pressures and flows in simple branching and loop pipe networks (3e)
- Students will be familiar with pump curves and will be able to determine the operating point for single, multistage, and parallel pump systems (3e)
- Students will apply Mannings equation to analyze and design for uniform conditions in open-channel flow (3e)
- Students will understand the concept of specific energy and be able to determine critical, subcritical and supercritical flow in open channels (3e)
- Students will develop and apply weir and orifice equations for measuring open channel flow rates (3e)
- Students will learn and apply standard methods of flood frequency analysis (3e)
- Student will learn how to delineate a watershed using both GIS-based and traditional hand methods (3e, 3k)
- Students will learn and apply two types of design storms commonly used in runoff analysis: IDF curves and the NRCS 24-hr design storm (3e)
- Students will estimate runoff volumes and peak flows by the two most common methods in design practice: the rational method and the curve number method (3e, 3k)
- Students will understand and apply the concept of the unit hydrograph (3e)
- Students will understand the basics of detention for runoff peak-flow reduction (3e)
- Students will understand the concepts of green infrastructure and stormwater best management practices (3j)
- Students will understand the concept of sustainability within a water resources engineering context (3j)
- Students will conduct laboratory and field experiments, and will analyze and interpret data using standard statistical analysis methods (3b)
- Students will improve their technical writing skills through lab memos, and a letter report to a client on a real-world stormwater project (3g)
- Students will develop their knowledge of contemporary and emerging issues related to water resources (3j)

General Expectations for Your Work

You are getting ever closer to the real world, where presentation and professionalism are critical elements of success. All written work (homework, labs, projects) must be done in a neat, professional manner, on engineering paper or computer output, with assumptions explicitly stated, solution steps clearly presented, references provided where necessary, and answers clearly indicated - see Division of Engineering Guidelines for Engineering Homework and the ASCE book *Professional Communications*. *Points may be taken off for poorly presented work.*

Grading

Distribution of points:

- Three exams: 100 pts each (60%)*
- Labs: 100 pts (20%)
- Homework: 75 pts (15%)
- Attendance, participation, and effort: 25 pts (5%)

* if one of your three exam scores is significantly lower than the other two, when calculating your average exam grade I will weight that particular exam by 20% rather than by 33%

Exams

Two 2-hour exams will be given in the evening during the semester (see course schedule, time and place to be determined). All exams are closed book and notes; however, you may bring one sheet of equations. I will provide all necessary parameter values, charts, tables, and unit conversions. Each exam covers the material discussed in class and lab since the previous exam. Exams will contain both quantitative problems and short-answer questions.

Laboratory

The laboratory portion of the course is particularly important because you will test and apply theoretical relationships in the real world, where things are never quite as straightforward as in textbook problems. As part of lab you will also learn some statistical methods for analyzing data. Because of the full-scale nature of the laboratory experiments and field work, students must work cooperatively in groups. You will generally be submitting a memo with attachments for each lab – these will be submitted by 3-person groups. Reports will be due one week from the date of the lab, unless otherwise noted. Late lab reports will be accepted only if you have made prior arrangements with me. Additional information on laboratory procedures and safety, as well as format for the memos will be provided on the first day of lab.

The final lab/homework assignment will be a multi-week design project involving runoff modeling and stormwater detention, based at nearby Sullivan Park. For this project you will write up your methods and results as a report to a client. Additional information will be provided later in the semester.

Two of the labs are field trips that cannot be held during the evening time block – *if you are in the evening lab section, make arrangements with me to attend the morning or afternoon lab*.

Homework

Homework assignments will be given on an approximately weekly basis. You are encouraged to work together on the problems – but this does not mean copying another person's solution! Homework will be graded based on completeness and your solutions (note the word "solutions" rather than "answers") to selected problems. Complete solutions will be available at my office after the homework is returned. Grades on late work will be reduced by 10% for each day the assignment is late, unless you have made prior arrangements with me.

Attendance, participation, and effort

More than three unexcused absences from class will reduce your final grade. Attendance is required at all laboratories. Because the College often hosts important speakers and events related to water resources issues, *attendance may be required (unless you have an unavoidable conflict) at several such events outside of our normal class time.*

To help you engage in the broader implications of water resources engineering, you (in 3-person teams) will take a turn at sharing an interesting current or historical news story related to water resources - see course webpage for some recent ones. This will happen each Friday at the beginning of class for ~5 min. You will provide links to your material on Wednesday so that we all have a bit of time to get acquainted with your topic before you present.

Policy on Personal Communications Devices

It is great to live in the digital information age, but it is a fact that our brains are not very good at multi-tasking. In order to promote you getting the most for your tuition dollars and to prevent disruption of other students' learning environment, cell phones/smart phones/wireless devices *must be turned off* in class. If you routinely disregard this policy, your attendance/participation grade will be adjusted accordingly.

A Note on Academic Dishonesty

Academic integrity is a cornerstone of higher education and cheating is an insult to your instructor and classmates. The College has clear written policies on academic dishonesty (see the on-line Student Handbook, pages 7, 20, and Appendix II). Suspected cases of academic dishonesty dealt with according to College policy. Nonetheless, you are encouraged to work together to solve the homework problems, but do not just copy a classmate's solution - make sure you understand and produce your own solution. When writing your lab reports and projects, be very careful to cite sources! A source must be given for any figures, graphics, or pictures used in your work (except your own). Information about specific format for citations and references will be provided in class.

and Finally, Some Quotations of Interest

"*Engineers … shall strive to comply with the principles of sustainable development*"
- ASCE Code of Ethics, Canon 1

"Thousands have lived without love, not one without water"
- W.H. Auden (20^{th} century poet)

"*When the well is dry, we know the worth of water*"
- Benjamin Franklin

"A man from the west will fight over three things: water, women and gold, and usually in that order"
- Barry Goldwater (Conservative/libertarian former Arizona Senator)