

CIEG 440-010: Water Resources Engineering

Syllabus for Fall Semester 2006

<u>Texts & Resources</u>	<u>Catalog Description</u>	<u>Course Objectives</u>
<u>Grading</u>	<u>Class Schedule</u>	<u>Class Format</u>
<u>Project Assignments</u>	<u>Advice for Success</u>	<u>Class Attendance</u>

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Fall 2006
 Mon 10:10 am - 11:00 am
 Wed 10:10 am - 11:00 am
 Fri 10:10 am - 11:00 am
 Room 120 Smith Hall

Texts & Resources

Linsley, R. K., J. B. Franzini, D. L. Freyberg and G. Tchobanoglous, 1992. *Water - Resources Engineering*. Fourth Edition. McGraw Hill.

* For supplementary resources, visit the library of the UD Water Resources Agency at the DGS Annex on Academy Street.

Important related web sites:

www.ce.udel.edu	University of Delaware Dept. of Civil and Environmental Engineering
www.wr.udel.edu	University of Delaware Water Resources Agency
www.udel.edu/dgs/	Delaware Geological Survey
www.ipa.udel.edu	Institute for Public Administration
www.dnrec.state.de.us	DE Dept. of Natural Resources and Environmental Control
www.drbc.net	Delaware River Basin Commission
www.epa.gov	U.S. Environmental Protection Agency
www.usgs.gov	U.S. Geological Survey
www.nationalatlas.gov	U.S. Geological Survey GIS Mapping Site
www.udel.edu/leathers/stclim.html	Department of Geography, Center for Climatic Research
www.bluehen.ags.udel.edu/spatlab/	College of Agriculture and Natural Resources

Catalog Description

This course is designed to review the fundamentals and practices of water resources engineering within the Civil and Environmental Engineering curriculum at the University of Delaware. Students will explore water resources engineering processes in the theoretical and applied realm in the fields of closed conduit (pipe) flow, open channel flow, surface water hydrology, water quality analyses, and groundwater flow. The water resources engineering curriculum is designed to prepare interested students for future careers in water supply, wastewater, floodplain, stormwater, and groundwater management. 3 credits.

Course Objectives

This course will enable students to:

1. Understand the design of water resources systems utilizing the basic principles of the hydrologic cycle and the watershed.
2. Review the fundamentals of fluid mechanics including fluid statics and dynamics.
3. Master the computation of flow in closed conduits including pipelines, pumps, and water supply systems.
4. Perform open channel flow design including water surface profiles, floodplain delineation, storm water and sanitary sewer design.
5. Understand the value of probability and statistical analysis in deriving precipitation and stream flow data.
6. Compute rainfall/runoff relationships for design of stormwater management systems.
7. Estimate pollutant loads for watershed and water quality analysis
8. Learn the equations of groundwater flow for applications in water well development and infiltration basin design.

Grading

Final grades will be based on the following parameters:

Participation/homework

Mid-term exam

Final exam

Design Project

Learning is enhanced when students can cooperate, rather than compete, with each other.

Therefore, grading will not be on a curve. If every student does excellent work, everyone will earn a high grade in this class. However, please note:

- * Quizzes may be given.
- * Weekly homework assignments will be given with work due the following Monday.
- * Make-up exams will not be scheduled unless due to hardship as approved by instructor.
- * No project will be accepted for grading after its due date.

Class Schedule

Wed Aug 30, 2006 - Introduction to water resources engineering

- * Introductions
- * Syllabus review
- * Federal, state, local water laws and agencies
- * The hydrologic cycle
- * Watershed management principles

Mon Sep 4 – Labor Day holiday, no classes

Module 1 - Fluid Mechanics

Wed Sep. 6 - Review of fluid statics

Mon Sep. 11 - Review of fluid dynamics/dimensional analysis

Module 2 - Closed Conduit Flow

Wed Sep 13 - Closed conduit flow (pipelines/pumps)

Mon Sep 18 - Design of water distribution systems

Wed Sep 20 - Practical exercise/design of Newark Reservoir pipeline

Mon Sep 25 - Field reconnaissance (Newark water treatment plant, pump station and reservoir pipeline)

Module 3 - Open Channel Flow

Wed Sep 27 - Continuity, momentum equations

Mon Oct 2 - Mannings and energy equations

Wed Oct 4 - Water surface profiles

Mon Oct 9 - Weir flow, orifice, culvert analysis

Wed Oct 11 - Practical exercise/delineation of White Clay Creek 100-year floodplain

Mon Oct 16 - Design of open channels/storm sewers/sanitary sewers

Wed Oct 18 - Practical exercise/ design of Newark storm sewer extension

Mon Oct 23 - Review for Midterm Examination

Wed Oct 25 - **Midterm Examination (1 hr.)**

Module 4 - Probability and Statistics

Mon Oct 30 - Probability/rainfall and stream discharge return intervals

Wed Nov 1 - Practical exercise: Drought of 2002 recurrence interval and 100-year flood frequency analysis (Tropical Storm Henri, Sep 2003)

Module 5 - Surface Water Hydrology

Mon Nov 6 - Rainfall depth, duration, distribution

Wed Nov 8 - Rainfall/runoff equations

Mon Nov 13 - Rainfall/runoff models (SCS CN model, Rational method), unit hydrograph, hydrologic routing models

Wed Nov 15 - Practical exercise, stormwater analysis, Silver Brook watershed, Newark, DE

Mon Nov 20 - Field reconnaissance/Blue Hen Creek/UD Experimental Watershed

Module 6 - Water Quality Analyses

Wed Nov 22 - Estimates of pollutant loads using modeling techniques

Thu Nov 23 through Sun Nov 26 - Thanksgiving recess

Mon Nov. 27 – Simple water quality dilution models

Module 7 - Groundwater Hydrology

Wed Nov 29 - Equations of groundwater flow (unconfined aquifers/confined aquifers/unsaturated flow)

Mon Dec 4 - Practical exercise (design of recharge facility for wellhead protection)

Wed Dec 6 - Review for final examination/term project due by 10:00 am/ class presentations

Wed Dec 11 - **In class Final Examination**

Class Format

Learning about water resources engineering is an active process where students participate in class discussions and hands-on exercises. We will be meeting in a classroom with ITV and projection equipment. We will be utilizing this equipment for course presentations and demonstration of computer models. Two sessions of the course will involve field reconnaissance and discussions of case studies to explore actual applications of water resources engineering. You are highly encouraged to ask questions regarding any topic on water resources engineering. Class participation and attendance for possible quizzes is strongly recommended as it counts for up to 25% of your grade. The course work will be rigorous but completion of the course will properly prepare you for a possible career in water resources engineering. The recommended class size is 30 to 60 students. Students should have prior knowledge of Fluid Statics/Dynamics.

Project Assignments

Water Resources Engineering Term Project

DUE:

Dec 6, 2005

Everyone will be assigned to a water resources engineering team of 4 to 6 students this semester. These groups will function independently during class and outside of class. For the term project, each team will select water resources engineering project such as floodplain delineation, stormwater detention design, reservoir design, etc and prepare a six-page report. All written work for the projects must be typed, spell checked, etc. Each team is responsible for a 10 - minute presentation to the class due on Dec 6, 2005.