

# CIEG 440-010: Water Resources Engineering Syllabus for Fall Semester 2013

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Fall 2013

Mon 6:00 - 9:00 pm

Room 006 Kirkbride Hall

## Texts & Resources

Brant., J. and G. J. Kauffman, 2011. Water Resources and Environmental Depth Reference Manual. Professional Publications, Inc. Belmont, California. 403 pp.

### Important related web sites:

[www.drbc.net](http://www.drbc.net)      Delaware River Basin Commission

[www.usgs.gov](http://www.usgs.gov)      U.S. Geological Survey

[www.nationalatlas.gov](http://www.nationalatlas.gov)      U.S. Geological Survey GIS Mapping Site

## Catalog Description

This course reviews 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 systems utilizing basic principles of the hydrologic cycle.
2. Review the fundamentals of fluid mechanics including fluid statics and dynamics.
3. Master computation of flow in closed conduits including pipelines, pumps, and water systems.
4. Perform open channel flow design for floodplain delineation, storm water/sanitary sewer design.
5. Understand 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 equations of groundwater flow for well development and infiltration basin design.

## Grading

Final grades will be based on the following parameters:

(1) participation/homework, (2) mid-term exam, (3) final exam, and (4) design project.

Learning is enhanced when students can cooperate, rather than compete, with each other. If every student does excellent work, everyone will earn a high grade in this class

- 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**

Mon Sep 9, 2013

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

### **Module 1 - Fluid Mechanics**

Review of fluid statics and fluid dynamics and dimensional analysis

### **Module 2 - Probability and Statistics**

Sep 16

- Probability/rainfall and stream discharge return intervals
- Practical exercise: Hurricane Irene flood frequency analysis.

### **Module 3 - Surface Water Hydrology**

Sep 23

- Rainfall depth, duration, distribution
- Rainfall/runoff equations
- Rainfall/runoff models (SCS CN model, Rational method), unit hydrograph

Sep 30

- Practical exercise, Blue Hen Creek watershed, Newark, DE
- Field reconnaissance/Blue Hen Creek/UD Experimental Watershed

### **Module 4 - Closed Conduit Flow**

Oct 7

- Closed conduit flow or flow under pressure (pipelines/pumps)
- Darcy Weisbach and Hazen Williams headloss formulae and Hardy Cross method

Oct 14

- Design of water distribution systems using EPANET 2 model
- Practical exercise/design of Newark Reservoir pipeline/Fairfield water network
- Field reconnaissance (Newark water treatment plant, pump station, pipeline)

Oct 21

- Midterm Examination

### **Module 3 - Open Channel Flow**

Oct 28

- Continuity, momentum equations, Mannings and energy equations

- Water surface profiles

Nov 4

- Weir flow, orifice, culvert analysis
- Practical exercise/delineation of White Clay Creek 100-year floodplain

Nov 11

- Design of open channels/storm sewers/sanitary sewers
- Practical exercise/ design of Newark storm sewer extension
- Review for midterm examination

### **Module 6 - Water Quality Analyses**

Nov 18

- Estimates of pollutant loads using modeling techniques
- Simple water quality dilution models

### **Module 7 - Groundwater Hydrology**

Nov 25

- Equations of groundwater flow (unconfined/confined aquifers/ unsaturated flow)
- Practical exercise (design of recharge facility for wellhead protection)

Thanksgiving recess

### **Module 8 – Water Policy**

Dec 2

- Water Law
- Water Economics
- Review of semester.

Dec 9

- 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. 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 your grade. The course work will be rigorous but will properly prepare you for a possible career in water resources engineering.

### **Project Assignments**

#### **Water Resources Engineering Term Project**

**DUE: Dec 9, 2013**

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 student will select a water resources engineering project such as floodplain delineation, stormwater detention design, reservoir design, etc and prepare a 10-page report.