Part I Course Organization
Course CE 465 Water Supply & Sewer System Design (3 units)

2014 Spring Semester — Course Syllabus

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Office Hours TBD

Teaching Assistant
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Blackboard https://blackboard.usc.edu/

Course Description

This course is designed to give seniors and first year graduate students in Civil/Environmental Engineering the ability to design the complete/comprehensive water supply and sewer systems (both sanitary sewer and storm drain), including all necessary pump station design.

Course and Learning Objectives

- To study and analyze the design criteria of overall water supply and sewer system.
  The student will be able to:
  1. Understand the hydraulics of pressure pipe flow and open channel gravity flow;
  2. Perform the population projection for a water and sewer system of a specified city to be designed for.

- To study and analyze the wells and reservoir and service storage for the water supply system.
  The student will be able to:
  1. Evaluate the capacity of the water wells to be served as the source of the water supply;
  2. Design the size of the storage reservoir based on the design criteria selected for the water supply system;
  3. Design the capacity of the elevated storage reservoir requirement based on the different pumping modes of the day;
  4. Determine the optimum storage capacity for the water supply system @ various unit cost of electricity.

- To layout and design the water distribution system.
  The student will be able to:
1. Perform fire flow testing to ensure firewater requirement is met;
2. Perform the Hardy Cross water network analysis to ensure the flow rate and pressure requirement are met;
3. Selection of the proper piping material for the water distribution system;
4. Analyze the water hammer problem in the water distribution system;
5. Layout the looped water distribution system.

- To layout the gravity sanitary sewer and storm drain system.

The student will be able to:
1. Perform the hydraulic analysis for the partially full pipe system;
2. Estimate the sanitary sewage flow rate based on the water supply requirement;
3. Estimate the surface runoff based on the rational method;
4. Perform layouts of both the sanitary and storm drain systems to eliminate the possible cross contamination with the potable water distribution system;
5. Pipe sizing and pipe material selection based on various pipe trenching and external loadings.

- To layout and design the pump station.

The student will be able to:
1. Estimate the size of the required pump and lift stations both for the water and sewer systems;
2. Estimate the total dynamic head (TDH) and horse power requirements for the pump station;
3. Perform general arrangement of a pump station with multiple pumps and its selection on the number of pumps required for the system design

**Prerequisite**  
CE453 Water Quality Control

**Class Day/Time/Location**  
Tuesday/6:30 to 9:10 P.M./KAP 148

**Required Textbook**  

**Computer Usage**  
EPANET for Hardy Cross Water Distribution Analysis

**Weekly Course Schedule**

1. General outline of water supply & sewer systems
2. Review of Hydraulics
3. Population projection
4. Water wells as water resource
5. Distribution reservoir and service storage
6. Water distribution network – Hardy Cross method
7. Fire water requirement and flow testing
8. Water Hammer analysis
9. Pump station design & pump selection
10. Wastewater flow estimate and analysis
11. Storm runoff analysis - Rational method
12. Sewer system design - Combined vs. separate system
13. Loads on buried pipe
14. Pipe selection and sewer appurtenances
15. Any additional subjects that students requested

Grading Scheme

<table>
<thead>
<tr>
<th>Weight</th>
<th>Component</th>
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<tbody>
<tr>
<td>10%</td>
<td>Homework Assignments</td>
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<tr>
<td>5%</td>
<td>Class Participation &amp; Discussion</td>
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<tr>
<td>20%</td>
<td>Term Project Progress Presentation (starting from mid-semester)</td>
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<tr>
<td>20%</td>
<td>Midterm Exam (1st Exam – Water Supply System)</td>
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<tr>
<td>20%</td>
<td>Final Exam (2nd Exam – Sewer System)</td>
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<td>25%</td>
<td>Term Project (Design of a Complete System for a Small Community - Due on the Day of Final Exam)</td>
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Attendance

Regular attendance will not be taken. However, examination questions will include items covered in lectures and distributed handouts that are not covered in the textbook. Each student is responsible for all announcements and material covered in class.

Late Work

- Weekly homework is due at 6:30 pm, one week after the assignment date.
- Solutions will be posted on the course Blackboard one week after the assignment date.
- Homework may be submitted after due date but before solutions are posted for 50% credit. Later submittals will not be accepted or graded.
Part II  Detailed Course Objectives
Course Information, Textbook, and Supplementary Materials

Course Description: Fundamentals of analysis and design of steel structures; structural elements; simple and eccentric connections; design project.

Capstone for: BSCE  
Design Kernel for: BSCE Environmental  
Required for: BSENE

Prerequisite: CE 453 Water Quality Control

Co-Requisite: None


Reference:

Topics Covered | Learning Outcomes
---|---
Water supply and sewage treatment systems | 1. Hydraulics review and population prediction  
2. Water wells as water source  
3. Distribution reservoir and service storage  
4. Water distribution network - Hardy Cross method  
5. Firewater requirement and flow testing  
6. Water hammer analysis  
7. Pump station design and pump selection  
8. Wastewater flow estimate and analysis  
9. Storm runoff analysis - Rational method  
10. Sewer system design - Combined vs. Separate system  
11. Loads on buried pipe  
12. Pipe selection and sewer appurtenances  
13. Water supply network analysis - E-PLANET

Computer program applications

Lecture and Lab Schedule

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<thead>
<tr>
<th>Lecture</th>
<th>Lab</th>
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<tr>
<td>Sessions per Week</td>
<td>Duration per Session</td>
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<tr>
<td>1</td>
<td>3 hours</td>
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Contribution of Course to Meeting the Professional Component

**Engineering Topics | Design**

Students will understand the design process and learn approaches used to solve various engineering problems that are representative of those found in a professional environment. They will practice decision-making skills as they apply their knowledge of basic sciences, mathematics, and the engineering sciences to convert resources optimally to meet the stated needs of a project.

In this class, students will learn the fundamentals of analysis and design of steel structures, structural elements, and simple and eccentric connections. The course culminates with a design project.

**Engineering Topics | Other**

**Constraints and Considerations.** Students will understand the diverse constraints and considerations that are representative of what they will encounter in an engineering practice. This course covers the following topics:

- Economic
- Environmental
- Sustainability
- Manufacturability
- Ethical
- Health and Safety
- Social
- Political
- Energy

Relation of Course Objectives to Program Outcomes

The Civil Engineering program is designed to teach beyond the technical content of the curriculum and prepare the students to utilize what they learn in a professional setting.

This course contributes to the program outcomes as outlined in the adjacent table.

<table>
<thead>
<tr>
<th>Course Contribution to Program Outcomes (a-k)</th>
<th>Key</th>
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<tr>
<td>c. An ability to design a system component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.</td>
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<td>d. An ability to function on multi-disciplinary teams.</td>
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<td>f. An understanding of professional and ethical responsibility.</td>
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<td>j. Knowledge of contemporary issues.</td>
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Prepared by: Dr. CC Wang

Date: Spring 2014