**Course Catalog Description:** Water supply, wastewater characteristics, design of unit processes for water and wastewater treatment, sludge processing, and related new technologies.

**Prerequisites:** ENVE 411 and ENVE 413

**Instructor:**
Yuefeng Xie, Ph.D., P.E., BCEE  
Professor of Environmental Engineering  
TL175  
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**Office Hours:**  
Tuesday: 2:00 pm-3:00 noon  
Wed: 12:00 noon – 1:00 pm  
(or by appointment)

**Co-Instructor**  
Yen-Chih Chen, Ph.D.  
Assistant Professor of Environmental Engineering  
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948-6695, fax 948-6580  
Yuc12@psu.edu

**Class Time & Location:**  
Monday and Wednesday 3:25-4:40 pm, TL 166.  
Monday 4:40 – 5:35 pm, TL 166

**Text:**  
*Water Supply and Pollution Control*, 6th Ed.  


**Reference Materials:**  
Various books related to water and wastewater plant design are reserved in library under ENVE 416

**Course Objectives:**  
Students will learn and demonstrate the ability to apply knowledge of mathematics, chemistry, microbiology courses, as well as environmental engineering and science courses in this capstone design course.
Students will learn and demonstrate the ability to design environmental systems (e.g., design a drinking water treatment plant and retrofit a wastewater treatment plant) which meet the design criteria and regulations of the Pennsylvania Department of Environmental Protection.

Students will learn the ability to function in a multidiscipline team through the design project and guest lectures.

Students will learn and demonstrate the ability to identify, formulate, and solve problems related to water quality and treatment, water resources and hydraulics, waste handling and disposal, hazardous waste and environmental safety through the capstone design project.

The course will provide the students with the understanding of professional and ethical responsibility through the design project, guest lectures, and a fluoride spill case study.

Students will learn and demonstrate the ability to communicate effectively through team work, report writing, project oral presentation. Students are required to provide written reports for their design projects and they are also required to orally present their projects in class and answer questions.

Students will learn the ability to recognize the need for, and the ability to engage in life-long learning through guest lectures, field trips, and their design projects.

Students will learn knowledge of contemporary issues in the environmental engineering field, including nutrient problems in Chesapeake Bay, membrane processes and UV disinfection, and current and future regulations and design criteria.

Students will learn the ability to use the various treatment techniques, computer technologies, and other modern engineering tools necessary for engineering practice.

**Description:**

This capstone design course will teach students how to integrate various design concepts they have learned from other environmental engineering, including ENVE 411 Water Supply and Pollution Control, ENVE 415 Hydrology, ENVE 417 Hydraulic Design, and ENVE 425 Hazardous Waste Management. Additional design and design related concepts will be introduced through a series of lecturer, seminars, tours, case studies, and design projects. Subjects covered include unit processes for water and wastewater treatment, hydraulic design, sludge handling and disposal, chemical storage and safety, project bidding and management, plant design and retrofitting, and engineering ethics and society impacts. After completion of this capstone design course, students should have basic knowledge in selection and design of conventional and modern environmental systems, especially water and wastewater treatment processes and application of knowledge they learned from various environmental engineering courses in solving real world engineering problems.
**Grading Policy:**
There will be one examination and two quizzes. The final course grade is determined using the following weights:

- Quizzes 1 & 2: 10%
- Examination (midterm): 20%
- Homework: 10%
- Projects and project updates: 30%
- Final Project and Presentation: 20%
- Class participation: 10%

You will be responsible for obtaining class notes and assignments from a missed class. Do not rely solely on the course outline for assignments.

**Field Trips:**
1. Wastewater Treatment plant (Middletown)
2. Drinking Water Treatment Plant (Harrisburg)
3. Pennsylvania American Water Company West Shore Water Plant (Mechanicsburg)

**Guest Lectures**
Various topics on water and wastewater plant design, hydraulic design, project bidding and management, and engineering ethics.

**Homework and Other Assignments**
1. Homework assignments will be collected at the start of class on the date given. Assignments received late will be penalized as follows:
   - Up to three days late: 20% off
   - Up to one week late: 50% off
   - One week late: no credit.
**Academic Integrity Policy:**
For university Academic Integrity Policy, please check the web site at
http://www.hbg.psu.edu/hbg/acadint.html

**ADA Policy:**
Note to students with disabilities:  It is Penn State’s policy not to discriminate against qualified students with documented disabilities in its educational programs. If you have a disability related need for modifications in this course, contact your instructor and the Disability Service Coordinator in the Student Assistance Center (W117, Olmsted, ext. 6025). Instructors should be notified during the first week of classes.

**Weather Policy:**
For university weather policy, please check the Inclement Weather Guidelines web site at
http://www.hbg.psu.edu/hbg/weater.html

**Learning Center:**
The Learning Center provides tutoring services and academic resources. To see the range of courses that we support, visit the Web site, www.hbg.psu.edu/LearningCenter/ , call 948-6475, or drop in to Olmsted C-216. You can schedule an appointment (individual or study group) for most math courses, any writing tutoring, or an academic skills coach at www.rich15.com/psuh. For tutoring in other courses, email tutorrequest@psu.edu. The center almost always can find a tutor, but can’t guarantee it. Learning Center handouts are available at the Learning Center and posted in the ANGEL group, Harrisburg Learning Center Resources. Contact Janice Smith, coordinator, jes57@psu.edu, with any questions.
Drinking Water Plant Design

You are hired to design a new conventional treatment processes with a pump station, a clear well, and distribution systems for the City of Middletown. Your design report should include the following items.

1. Population projection (State Data Center, on campus) and water demands
2. Comparison of various surface and groundwater sources
3. Preliminary design for all major unit processes
   - The surface water source is chosen by the City
   - The design should address the current and future federal and state regulations.
   - Taste and odor control is a major concern of the City
   - Fluoridation is required by the City
   - Treatment plant wastes need to be addressed
   - Chemical storage and safety, especially for chlorine gas, need to be addressed.
   - Filter Backwash water tank, treatment and recycle or disposal
   - Finished water storage structures if required
   - Booster pumps and hydropneumatic tanks if required
4. Plant site and layout
5. Process train and hydraulic grade line (using AutoCAD)
6. Plant laboratory
7. Construction cost estimates

Wastewater Treatment Plant Design

Retrofit the Middletown Wastewater Treatment Plant to meet the Pennsylvania Department of Environmental Protection’s Chesapeake Bay Initiative requirements. Your report should include:

1. Preliminary design for all major unit processes
2. Plant site and layout
3. Process train and hydraulic grade line (using AutoCAD)
4. Plant laboratory
5. Construction cost estimates
Reserved References for ENVE 416

ENVE 416 Treatment Plant Design
Instructor: Yuefeng Xie, 948-6415, yxx4@psu.edu
Loan time: Three Days

**Integrated design and operation of water treatment facilities**
Kawamura, Susumu.
**Publisher:** John Wiley & Sons,
**Pub date:** c2000.
**Pages:** xvii, 691 p. :
**ISBN:** 0471350931
TH4538.K38 2000

**Water treatment plant design**
Baruth, Edward E.
**Publisher:** McGraw-Hill,
**Pub date:** c2005.
**Pages:** 1 v. (various pagings) :
**ISBN:** 0071418725
TD434.W38 2005

**Water treatment : principles and design**
Crittenden, John.
**Publisher:** John Wiley,
**Pub date:** c2005.
**Pages:** xx, 1948 p. :
**ISBN:** 0471110183
TD430.W375 2005

**Water works engineering : planning, design, and operation**
Qasim, Syed R.
**Publisher:** Prentice Hall PTR,
**Pub date:** c2000.
**Pages:** xvi, 844 p. :
**ISBN:** 0131502115
TD434.Q23 2000

**Water treatment plant design**
American Society of Civil Engineers.
**Publisher:** McGraw-Hill,
**Pub date:** c1998.
**Pages:** x, 806 p. :
**ISBN:** 0070016437
TD434.W38 1998
Design of municipal wastewater treatment plants
  Joint Task Force of the American Society of Civil Engineers and the Water Pollution Control Federation.
  Publisher: Water Pollution Control Federation ;
  Pub date: 1991.
  Pages: 2 v. :
  ISBN: 0943244838
TD746.D47 1991 v.1
TD746.D47 1991 v.2

Upgrading and retrofitting water and wastewater treatment plants
  Publisher: McGraw-Hill,
  Pub date: c2005.
  Pages: xxi, 230 p. :
  ISBN: 0071453032
TD746.U64 2005

Biological nutrient removal (BNR) operation in wastewater treatment plants
  Publisher: McGraw-Hill,
  Pub date: c2006.
  Pages: xlv, 597 p. :
  ISBN: 0071464158
TD746.B56 2006

Wastewater engineering : treatment and reuse
  Tchobanoglous, George.
  Publisher: McGraw-Hill,
  Pages: xxviii, 1819 p. :
  ISBN: 0071122508
TD645.W295 2003