



## Course Number and Title: ENV 260 Water/Wastewater Process Design

**Campus Location:**  
Georgetown, Stanton

**Effective Date:**  
2018-52

**Prerequisite:**  
BIO 150 or concurrent, CHM 110, CET 125, ENV 190, MAT 180

**Co-Requisites:**  
None

**Course Credits and Hours:**  
3.00 credits  
2.00 lecture hours/week  
2.00 lab hours/week

### Course Description:

This course covers the engineering principles and design criteria of basic environmental control processes; coagulation/flocculation basins; clarifiers; gravity filters; activated sludge systems; stabilization ponds; chemical treatment processes for disinfection, nitrate, and volatile organic compound (VOC) removal; advanced wastewater treatment processes for suspended solids; phosphate and nitrate removal; carbon absorption; and various wastewater reclamation processes.

### Required Text(s):

Obtain current textbook information by viewing the [campus bookstore - https://www.dtcc.edu/bookstores](https://www.dtcc.edu/bookstores) online or visit a campus bookstore. Check your course schedule for the course number and section.

**Additional Materials:**  
Scientific Calculator

**Schedule Type:**  
Classroom Course

**Disclaimer:**  
None

### Core Course Performance Objectives (CCPOs):

1. Identify the rules and regulations that govern water and wastewater treatment. (CCC 5; PGC EET 1, 4, 5, 6)
2. Describe the chemical properties associated with water and wastewater technologies. (CCC 1, 5, 6; PGC EET 1, 2)
3. Describe the biological properties associated with water and wastewater technologies. (CCC 1, 5, 6; PGC EET 1, 2)
4. Identify and calculate the hydraulic principles associated with water distribution and wastewater collection systems. (CCC 1, 2, 5, 6; PGC EET 1, 4)
5. Identify the components that compose a water distribution systems, and determine necessary pipe sizes and fire flows. (CCC 1, 2, 5, 6; PGC EET 1, 4)
6. Calculate the basic design parameters, and state the operating principles of importance in domestic water treatment processing, including coagulation, flocculation, sedimentation, filtration, and disinfection. (CCC 1, 2, 5, 6; PGC EET 1, 2, 4)
7. Describe wastewater flows and characteristics. (CCC 1, 5, 6; PGC EET 1, 4, 5)
8. Identify the components that comprise a wastewater collection system, and determine necessary pipe sizes. (CCC 1, 5, 6; PGC EET 1, 4)
9. Calculate the basic design parameters and state the operating principles of importance in domestic wastewater treatment processing, including preliminary treatment, primary treatment, secondary treatment, sludge treatment, and disinfection. (CCC 1, 2, 5, 6; PGC EET 1, 2, 4)
10. Discuss performance evaluations of treatment plants. (CCC 1, 2, 5, 6; PGC EET 1, 2, 4, 6)
11. Demonstrate professional and ethical conduct as expected in industry. (CCC 1, 3, 4; PGC EET 1, 3, 6)

See Core Curriculum Competencies and Program Graduate Competencies at the end of the syllabus. CCPOs are linked to every competency they develop.

### Measurable Performance Objectives (MPOs):

Upon completion of this course, the student will:

1. Identify the rules and regulations that govern water and wastewater treatment.
  1. Summarize the Safe Drinking Water Act.
  2. Summarize the Clean Water Act.
  3. Describe the National Pollutant Discharge Elimination System (NPDES).

4. Identify local regulations that govern water and wastewater treatment.
2. Describe the chemical properties associated with water and wastewater technologies.
  1. Identify the fundamental chemical reactions involved in water and wastewater treatment.
  2. Identify how alkalinity impacts treatment processes, and calculate alkalinity.
  3. Describe and identify organic compounds.
  4. Describe and identify inorganic compounds.
  5. Identify how the following impact facility processes and/or the environment: iron and manganese, phosphorous, nitrogen, dissolved oxygen, chlorine, and fluoride.
  6. Describe chemical tests and equipment used to sample water and wastewater processes.
3. Describe the biological properties associated with water and wastewater technologies.
  1. Identify the causes of waterborne diseases, and describe how they may impact the environment and human health.
  2. Describe the tests performed to identify if waterborne diseases are present.
  3. Define *biochemical oxygen demand* (BOD), and describe its significance with regards to water and wastewater treatment.
  4. Describe the factors that affect biological growth within systems.
4. Identify and calculate the hydraulic principles associated with water distribution and wastewater collection systems.
  1. Calculate the flow in a pipe under pressure.
  2. Calculate the head loss of a system.
  3. Interpret a pump curve.
  4. Calculate the flow measurements in an open channel.
  5. Calculate the flow in a gravity pipe.
5. Identify the components that compose a water distribution systems, and determine necessary pipe sizes and fire flows.
  1. Compute the amount of fire flow needed.
  2. Describe the various layouts of distribution systems.
  3. Identify the types of pipes and connections used in a distribution system.
  4. Describe the different valves used in a distribution system.
6. Calculate the basic design parameters, and state the operating principles of importance in domestic water treatment processing, including coagulation, flocculation, sedimentation, filtration, and disinfection.
  1. Describe the sedimentation process, and calculate the detention time and surface loading rate of the clarifier.
  2. Describe the coagulation and flocculation process.
  3. Identify the different types of coagulants used in the treatment process.
  4. Describe the filtration process and the components of a filtration system.
  5. Calculate the chlorine demand of a system and the chlorine travel time.
  6. Discuss membrane treatment technologies.
  7. Identify sludge disposal methods.
7. Describe wastewater flows and characteristics.
  1. Describe the wastewater characteristics of domestic, commercial, and industrial waste.
  2. Compare grab and composite sampling.
8. Identify the components that comprise a wastewater collection system, and determine necessary pipe sizes.
  1. Describe a storm sewer.
  2. Identify the components of a sanitary sewer system.
  3. Identify the construction and installation practices used to install a collection system.
  4. Identify the testing procedures used to test for water tightness.
  5. Calculate necessary pipe sizes.
9. Calculate the basic design parameters and state the operating principles of importance in domestic wastewater treatment processing, including preliminary treatment, primary treatment, secondary treatment, sludge treatment, and disinfection.
  1. Describe preliminary treatment.
  2. Describe primary treatment.
  3. Calculate the detention time, surface area, and total volume of a primary clarifier.
  4. Describe secondary treatment processes to include biological towers, tricking filters, activated sludge, and extended aeration systems.
  5. Calculate organic loading and nutrient loading to and from a system.
  6. Calculate the hydraulic loading to a system.
  7. Calculate the food to microorganism ratio.
  8. Calculate the sludge age and return sludge rate.
  9. Calculate the efficiency rates of the treatment system.
  10. Calculate the aeration needs of a system.
  11. Describe stabilization ponds and their uses.
  12. Describe the various types of sludge-thickening processes.
  13. Compare and contrast chlorination and ultraviolet disinfection.
10. Discuss performance evaluations of treatment plants.
  1. Identify how performance is measured at a facility.
  2. Discuss the different types of facility audits.
  3. Describe an asset management plan, and explain what is included in one.
11. Demonstrate professional and ethical conduct, as expected in industry.
  1. Identify the need for self-discipline and time management in technical industries.
  2. Communicate and function effectively as a member of a team.

**Evaluation Criteria/Policies:**

Students must demonstrate proficiency on all CCPOs at a minimal 75 percent level to successfully complete the course. The grade will be determined using the Delaware Tech grading system:

92	-	100	=	A
83	-	91	=	B
75	-	82	=	C
0	-	74	=	F

Students should refer to the [Student Handbook - https://www.dtcc.edu/handbook](https://www.dtcc.edu/handbook) for information on the Academic Standing Policy, the Academic Integrity Policy, Student Rights and Responsibilities, and other policies relevant to their academic progress.

**Final Course Grade:**

Calculated using the following weighted average

Evaluation Measure	Percentage of final grade
Summative: 3 Exams (weighted equally)	30%
Summative: Final Project	15%
Formative: Assignments (Quizzes, Readings, Participation, Design Problems, etc.)	55%
TOTAL	100%

**Core Curriculum Competencies (CCCs are the competencies every graduate will develop):**

1. Apply clear and effective communication skills.
2. Use critical thinking to solve problems.
3. Collaborate to achieve a common goal.
4. Demonstrate professional and ethical conduct.
5. Use information literacy for effective vocational and/or academic research.
6. Apply quantitative reasoning and/or scientific inquiry to solve practical problems.

**Program Graduate Competencies (PGCs are the competencies every graduate will develop specific to his or her major):**

1. Apply the knowledge, techniques, skills, and applicable tools of the discipline to engineering activities, including but not limited to site development, hydraulics and hydrology, grading, water and wastewater treatment, pollution prevention and treatment, and sustainable design.
2. Conduct standardized field and laboratory testing.
3. Demonstrate a commitment to quality, timeliness, professional development, and continuous improvement.
4. Use graphic techniques and productivity software to produce technical documents.
5. Explain the major aspects of the normal ecology of the planet and risks associated with polluting the environment.
6. Apply current federal, state, and local environmental and safety regulations and industry best management practices.

**Disabilities Support Statement:**

The College is committed to providing reasonable accommodations for students with disabilities. Students are encouraged to schedule an appointment with the campus Disabilities Support Counselor to request an accommodation needed due to a disability. A listing of campus Disabilities Support Counselors and contact information can be found at the [disabilities services - https://www.dtcc.edu/disabilitysupport](https://www.dtcc.edu/disabilitysupport) web page or visit the campus Advising Center.