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

Campus Location:
Stanton

Effective Date:
2022-51

Prerequisite:
BIO 150 or concurrent, CHM 110, CET 125, ENV 190, (MAT 183 or higher)

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 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. Explain the rules and regulations that govern water and wastewater treatment. (CCC 1, PGC EET 1, 4, 5, 6)
2. Explain the chemical properties associated with water and wastewater technologies. (CCC 1, 6; PGC EET 1)
3. Explain the biological properties associated with water and wastewater technologies. (CCC 1, 6; PGC EET 1)
4. Explain and calculate the hydraulic principles associated with water distribution and wastewater collection systems. (CCC 1, 2, 6; PGC EET 1, 4)
5. List the components that compose a waterdistribution system, and determine necessary pipe sizes and fire flows. (CCC 1, 2, 6; PGC EET 1, 4)
6. Calculate the basic design parameters, and explain the operating principles of importance in domestic water treatment processing, including coagulation, flocculation, sedimentation, filtration, and disinfection. (CCC 1, 2, 6; PGC EET 1, 4)
7. Explain wastewater flows and characteristics. (CCC 1, 6; PGC EET 1, 4, 5)
8. Explain the components that comprise a wastewater collection system, and determine necessary pipe sizes. (CCC 1, 6; PGC EET 1, 4)
9. Calculate the basic design parameters and explain the operating principles of importance in domestic wastewater treatment processing, including preliminary treatment, primary treatment, secondary treatment, sludge treatment, and disinfection. (CCC 1, 2, 6; PCG EET 1, 2, 4)
10. Explain performance evaluations of treatment plants. (CCC 1, 2, 6; PGC EET 1, 2, 4, 6)
11. Demonstrate professional and ethical conduct, as expected in industry. (CCC 1, 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. Explain the rules and regulations that govern water and wastewater treatment.
    1. Explain the Safe Drinking Water Act.
    2. Explain the Clean Water Act.
    3. Explain the National Pollutant Discharge Elimination System (NPDES).
    4. List local regulations that govern water and wastewater treatment.
2. Explain the chemical properties associated with water and wastewater technologies.
    1. Explain the fundamental chemical reactions involved in water and wastewater treatment.
    2. Explain how alkalinity impacts treatment processes, and calculate alkalinity.
    3. List organic compounds.
    4. List inorganic compounds.
    5. Explain how the following impact facility processes and/or the environment: iron and manganese, phosphorous, nitrogen, dissolved oxygen, chlorine, and fluoride.
    6. List chemical tests and equipment used to sample water and wastewater processes.
3. Explain the biological properties associated with water and wastewater technologies.
    1. List the causes of waterborne diseases, and describe how they may impact the environment and human health.
    2. List the tests performed to identify if waterborne diseases are present.
    3. Explain *biochemical oxygen demand* (BOD), and describe its significance with regards to water and wastewater treatment.
    4. Explain the factors that affect biological growth within systems.
4. Explain 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. List the components that compose a water distribution system, and determine necessary pipe sizes and fire flows.
    1. Compute the amount of fire flow needed.
    2. Explain the various layouts of distribution systems.
    3. Explain the types of pipes and connections used in a distribution system.
    4. List the different valves used in a distribution system.
6. Calculate the basic design parameters, and explain the operating principles of importance in domestic water treatment processing, including coagulation, flocculation, sedimentation, filtration, and disinfection.
    1. Explain the sedimentation process, and calculate the detention time and surface loading rate of the clarifier.
    2. Explain the coagulation and flocculation process.
    3. List the different types of coagulants used in the treatment process.
    4. Explain the filtration process and the components of a filtration system.
    5. Calculate the chlorine demand of a system and the chlorine travel time.
    6. Explain membrane treatment technologies.
    7. List sludge disposal methods.
7. Explain wastewater flows and characteristics.
    1. Explain the wastewater characteristics of domestic, commercial, and industrial waste.
    2. Compare grab and composite sampling.
8. Explain the components that comprise a wastewater collection system, and determine necessary pipe sizes.
    1. Explain a storm sewer.
    2. List the components of a sanitary sewer system.
    3. Explain the construction and installation practices used to install a collection system.
    4. Explain the testing procedures used to test for water tightness.
    5. Calculate necessary pipe sizes.
9. Calculate the basic design parameters and explain the operating principles of importance in domestic wastewater treatment processing, including preliminary treatment, primary treatment, secondary treatment, sludge treatment, and disinfection.
    1. Explain preliminary treatment.
    2. Explain primary treatment.
    3. Calculate the detention time, surface area, and total volume of a primary clarifier.
    4. Explain 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. Explain stabilization ponds and their uses.
    12. Explain the various types of sludge-thickening processes.
    13. Compare and contrast chlorination and ultraviolet disinfection.
10. Explain performance evaluations of treatment plants.
    1. Explain how performance is measured at a facility.
    2. Compare the different types of facility audits.
    3. Explain 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:
The grade will be determined using the Delaware Tech grading system:

90	–	100	=	A
80	–	89	=	B
70	–	79	=	C
0	–	69	=	F

Students should refer to the Student 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 – 4 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):
ENVAASEET

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 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 web page or visit the campus Advising Center.