

ERE 520 Wastewater Resource Recovery

Semester: Spring 2021

Credit hours: 2

Class meeting times: Tue and Thu 8:25–9:20 am Zoom Meeting in Blackboard

Instructor of record: Dr. Wendong Tao

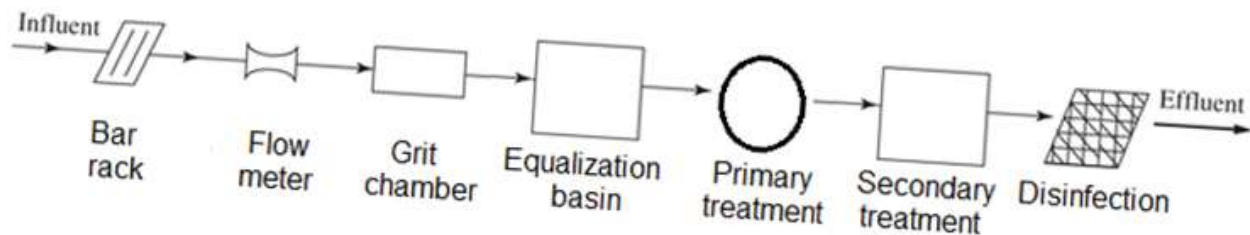
Office location: 422 Baker

Office hours: Monday 2:30 pm to 4:00 pm by appointment only

Contact: wtao@esf.edu; (315) 470-4928

Course Description

Two hours of lecture, presentations and discussion per week. Introduction to technologies for recovery of bioenergy and nutrients from liquid wastes as well as the principles and applications of laboratory methods used in development and assessment of wastewater resource recovery processes. Presentation and discussion of experimental results for comprehensive analysis of anaerobic digesters. Spring.



Prerequisite: One of ERE480 Fate and Transport of Contaminants; FCH 510 Environmental Chemistry I; and FCH515 Methods of Environmental Chemical Analysis.

Course Learning Outcomes

After completing this course, the students should be able to:

1. Apply the principles of anaerobic digestion processes and nutrient transformations to design and analysis of wastewater resource recovery systems;
2. Design experiments to recover resources from wastewater and use laboratory results to assess resource recovery systems; and
3. Simulate and analyze the kinetics of anaerobic digestion and nutrient recovery processes using non-linear curve fitting with Excel Solver.

Program (BS in ERE) Learning Outcomes

(I = Introduction, R = Reinforce, E = Emphasize, A = ABET Criteria 3 assessment)

1. [R] an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science and mathematics
2. [I] an ability to apply engineering design to produce solutions that meet specific needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. [I] an ability to communicate effectively with a range of audiences
4. [I] an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in a global, economic, environmental, and societal context
5. [I] an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. [E] an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. [] an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

College Learning Outcomes: *[Choose the following that this course addresses]*

1. Scientific reasoning;
2. Quantitative reasoning;
3. Basic communication skills;
4. Technological and information literacy;
5. Values, ethics and diverse perspectives; and
6. Critical thinking.

Textbook and Supplies:

- Learning Guide and Lab Manual. To be circulated over the semester.

- Standard Methods for the Examination of Water and Wastewater, 22nd ed. 2012 (or 21st ed. 2005). APHA/AWWA/WEF. Moon Library - Reference. Call #: QD142 .A5 2005. (Suggested readings)

Lecture Topics:

1. Solids analysis in liquid, solid and sludge samples
2. Carbon transformation in anaerobic digestion
 - 2.1. Anaerobic digestion process
 - 2.2. Alkalinity
 - 2.3. Chemical oxygen demand (COD)
3. Design and analysis of anaerobic digestion
4. Nitrogen and phosphorus transformations in anaerobic digestion
 - 4.1. Nitrogen transformation
 - 4.2. Ammonia speciation
 - 4.3. Phosphorus speciation and transformation
5. Ammonia recovery
6. Phosphate recovery

Attendance Policy:

Class attendance and participation in discussion are required.

Grading

- | | | |
|----|---|---------|
| a. | Participation in Lab #1, Lab #2, and Lab #9: | 5% x 3 |
| b. | Discussion on Lab #3, 4, & 6-8 presentations: | 7% x 5 |
| c. | Lab #5 report: | 20% |
| d. | Two assignments: | 15% x 2 |
- Lab #1: Lab safety and orientation*
Lab #2: Environmental Health and Safety Training
Lab #3: Analysis of solids in solid, liquid, and sludge samples
Lab #4: Alkalinity and COD of anaerobic digestion samples
Lab #5: Determination of anaerobic digestion kinetics
Lab #6: Determination of ammonia
Lab #7: Determination of ortho-phosphate
Lab #8: Kjeldahl digestion for TKN and TP analyses
Lab #9: Demo of ammonia and phosphate recovery from digestate

Students with Learning and Physical Disabilities

SUNY-ESF works with the Office of Disability Services (ODS) at Syracuse University, who is responsible for coordinating disability-related accommodations. ODS is responsible for coordinating disability-related academic accommodations and will work with the student to develop an access plan. Since academic accommodations may require early planning and generally are not provided retroactively, please contact ODS

as soon as possible to begin this process. To discuss disability-accommodations or register with ODS, please visit their website at <http://disabilityservices.syr.edu>. Please call (315) 443-4498 or email disabilityservices@syr.edu for more detailed information.

Academic Dishonesty

Academic dishonesty is a breach of trust between a student, one's fellow students, or the instructor(s). Examples of academic dishonesty includes but is not limited to plagiarism and cheating, and other forms of academic misconduct. By registering for courses at ESF you acknowledge your awareness of the ESF Code of Student Conduct. More information regarding Academic Integrity, including the process for resolving alleged violations, can be found in the Student Handbook (<https://www.esf.edu/students/handbook/>).

Inclusive Excellence Statement

As an institution, we embrace inclusive excellence and the strengths of a diverse and inclusive community. During classroom discussions, we may be challenged by ideas different from our lived experiences and cultures. Understanding individual differences and broader social differences will deepen our understanding of each other and the world around us. In this course, all people (including but not limited to, people of all races, ethnicities, sexual orientation, gender, gender identity and expression, students undergoing transition, religions, ages, abilities, socioeconomic backgrounds, veteran status, regions and nationalities, intellectual perspectives and political persuasion) are strongly encouraged to respectfully share their unique perspectives and experiences. This statement is intended to help cultivate a respectful environment, and it should not be used in a way that limits expression or restricts academic freedom at ESF.