



Wastewater Treatment Technology

3 weekly hours, 3 credit hours (hands on treatment technology) Undergraduate

Overview

This course is about wastewater treatment processes and technology, with an overview of the operation and maintenance of wastewater plants and different treatment processes. This course is intended to provide guidance and criteria for the design and selection of small-scale wastewater treatment plants. It provides both the information necessary to select, size, and design such wastewater treatment unit processes.

This subject will provide methods and technical issues related to integrated water services, treatment and reuse of water, with particular reference to urban areas.

This course designed to achieve the following objectives:

1. advancing the students' knowledge in wastewater treatment systems and enhancing the principles of treatment plants design aspects.
2. Introduce fundamentals of the wastewater treatment plants and their unit operations and processes.
3. Provide basic design skills and knowledge on the wastewater treatment plants and their unit operations and processes.

Specific Goals

Students who successfully complete this course will be able to:

- Recognize the relationship between the natural water and human water use.
- Relate mechanisms and processes of water and wastewater constituents.
- Identify different types of reuses for the reclaimed water.
- Identify the suitability of the use of treated wastewater for irrigation and to evaluate the optimal method for the management of wastewater.
- Learn the sample handling, collection, quality control and analysis

Course Requirements

The course will include laboratory and field work (water sampling and field analysis), worksheets, exercises, readings, etc. In addition, participating in the lab and class discussions, students will have a midterm exam, final exam.

Laboratory

The laboratory will provide hands-on experience in wastewater analytical skills. During the lab work, wastewater sampling from wastewater treatment plants will be taken, sampling methodology will be explained, as well as a prototype treatment design.

Grade components

Attendance, participation, discussions 15%

Quizzes, Assignments, Readings 10%

Student project 10%

Midterm exam 10%

Laboratory work and reports 25%

Final exam 30%

Schedule

#	Topic	Topic
1	An Overview: Features of the municipal wastewater 1. Typical values of water demand - Residential water demand estimation - Domestic household wastewater effluents, sources and characteristic	Features of the municipal wastewater Typical values of water demand. Composition of the municipal wastewater
2	Features of the municipal wastewater Typical values of water demand Composition of the municipal wastewater Frank R. Spellman, Handbook of Water and Wastewater Treatment Plant Operations, (pages 46-55)	Lab: Safety manual - Lab safety policy & Interpreting Test Reports, Sampling and management <u>Lab measurement units</u>
3	Features of the municipal wastewater 1. Typical sewage flow rate values and the theory of simplified sewer design 2. Sanitary sewage design flow rates 3. Sustained peak flow rate and sustained minimum flow rate Arcadio P. Sincero Sr., D.Sc., P.E., Physical chemical treatment of water and wastewater, First Edition, (pages 95-108 and 130-135)	- Flow rate and peak calculator - Simulator for municipal wastewater treatment systems
4	Stages of wastewater treatment plant Preliminary treatments, Primary treatment, Secondary treatment and Tertiary treatments. - Coagulation and flocculation - Sedimentation - Filtration - Disinfection and chlorination - Sedimentation and Flotation Frank R. Spellman, Handbook of Water and Wastewater Treatment Plant Operations, (pages 492-497 and 503-508)	Tests needed to evaluate level of pollution (pH, EC, TDS)
5	Stages of wastewater treatment plant Preliminary treatments, Primary treatment, Secondary treatment and Tertiary treatments. - Trickling Filters - Rotating Biological Contactors - Activated Sludge - Stabilization Ponds Frank R. Spellman, Handbook of Water and Wastewater Treatment Plant Operations, (pages 349-354)	Tests needed to evaluate level of pollution (NO ₃ , NO ₂ , NH ₄)
6	Wastewater pollution Load Estimation - organic concentration - nutrient concentration solids concentration	Guest lecturer Dr. Ahmad Naser
7	Wastewater characteristics and effluent quality parameters - Odor, color, turbidity, pH and EC - Hydrogen sulphide - Nitrogen (nitrification/denitrification) - Biological Phosphorus amendment - Potassium amendment	Tests needed to evaluate level of pollution (TPC, FC and TC)

	Arcadio P. Sincero Sr., D.Sc., P.E., Physical chemical treatment of water and wastewater, First Edition, (pages 144-147 and 149-160)	
8	Small scale wastewater treatment plant sequences 1. Very Small Plants (Single Dwelling up to approximately 5cm/d). 2. Small Plants (5cm/d upto 20cm/d). 3. Medium Sized Plants (200cm/d upto 5000cm/d). 4. Large Plants (> 5000cm/d). DJ Nozaic and SD Freese, Process Design Manual for Small Wastewater Works (pages 23-28)	Tests needed to evaluate level of pollution (BOD, TSS, TS)
9	Tests needed to evaluate level of pollution (COD)	Field trip to WWTP
10	Classification model: selecting appropriate sanitation technology compatible with the community capacity	Tests needed to evaluate level of pollution (Cl, Cl ₂ , HCO ₃)
11	Design parameters for water treatment plant units - Initial prototype design - Shuokr Qarani Aziz et al.,2019. Step-by-step design and calculations for water treatment plant units. Advances in Environmental Biology 13(8): 1-16.	Tests needed to evaluate level of pollution (Ca, Mg)
12	Design parameters for water treatment plant units - Water Treatment Plant (WTP) Design flow rate capacity - Determining dimension of the cross section of the channel - <u>Design considerations</u>	Step-by-step design and calculations for water treatment plant units Practical Lab exam
13	Final course exam	

Text Book and reading documents:

1. Handbook of Water and Wastewater Treatment Plant Operations by Frank R. Spellman, LEWIS PUBLISHERS, CRC Press Company, Boca Raton London New York Washington, D.C. 2003
2. Physical chemical treatment of water and wastewater, First Edition, Arcadio P. Sincero Sr., D.Sc., P.E. Morgan State University, Baltimore, Maryland, Gregoria A. Sincero, M. Eng., P.E. Department of the Environment State of Maryland 2003
3. Process Design Manual for Small Wastewater Works by DJ Nozaic and SD Freese, Water Research Commission, ISBN 978-1-77005-826-2, Printed in the Republic of South Africa. 2009.
4. Shuokr Qarani Aziz et al., 2019. Step-by-step design and calculations for water treatment plant units. Advances in Environmental Biology 13(8): 1-16. DOI:10.22587/aeb.2019.13.8.1