ENE-303: Wastewater Collection and Treatment

CREDIT HOURS:	Theory	= 3	Practical	= 1	Total	= 4
CONTACT HOURS:	Theory	= 48	Practical	= 48	Total	= 96
PREREQUISITE:	Introduction to Environmental Engineering					
MODE OF TEACHING:	Three hours of lecture and three hours lab per week (75+25) %					

COURSE DESCRIPTION:

To understand wastewater collection systems in terms of design, operation, and maintenance; to introduce principles of pumping stations, infiltration, force mains, gravity sewers, invert levels, lift stations, manholes, etc.; to understand fundamentals of treating municipal wastewater and overview of design concepts and processes; to review the biological treatment processes and design concepts.

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Teamwork:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☑	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

COURSE LEARNING OUTCOMES (CLOs):

Upon successful completion of the course, the student will demonstrate competency by being able to:

S. No	CLOs	Domain	Taxonomy Level	PLOs
1	**UNDERSTAND** fundamentals of wastewater generation and collection	Cognitive	2	1
2	**ANALYZE** wastewater treatment unit operations and processes.	Cognitive	4	2
3	**EVALUATE** wastewater treatment plant design.	Cognitive	5	3
4	**FOLLOWS** procedures for wastewater treatment unit design, operation, and performance evaluation	Psychomotor	3	5
5	**Maintain** ethical conduct in lab and adhere to lab safety procedures while	Affective	5	8

	contributing effectively towards individua and/ or group goals.			

Complex Engineering Problem

6	**Apply** biological techniques for wastewater treatment.	Cognitive	3	2

TOPICS COVERED WITH THEIR CONTRIBUTION TO PLOs:

Theory:

Week	Topic
1	Wastewater generation and impurities
2	Wastewater collection components
3	Appurtenances and structures
4	Design of wastewater collection systems
5	Basic process design parameters
6	Decentralized Wastewater Treatment System (DWTS)
7	Waste Stabilization Ponds
8	Aerobic treatment of wastewater
Mid Semester Exam	
9	Suspended growth process
10-11	Design of Activated Sludge Process
12	Attach growth process
13	Design of Trickling Filters
14-15	Anaerobic Biological Treatment Processes
16	Sludge Treatment and Handling
End Semester Exam	

Practical:

S. No.	Title
1	Determination of Dissolved Oxygen and Biochemical Oxygen Demand
2	Determination of Chemical Oxygen Demand
3	Determination of Total Organic Carbon
4	Determination of Orthophosphates and Total Phosphorus
5	Determination of Nitrite and Nitrate Nitrogen
6	Determination of Ammonia and Kjeldahl Nitrogen
7	Determination of Heavy Metals in wastewater
8	Determination of Sludge Volume Index
9	Determination of Volatile Fatty Acids for anaerobic treatment processes
10	Introduction to GPS-X and its applications in Wastewater treatment

TEXT AND MATERIAL:

Textbook(s)
- "Theory and Practice of Water and Wastewater Treatment", Ronald L. Droste (1996)

References Material:

- "Wastewater Engineering, Treatment and Resource Recovery", 5th Edition by Metcalf & Eddy (2013)
- "Biological Wastewater Treatment", Third Edition 3rd Edition by C. P. Leslie Grady Jr (2011)

ASSESSMENT SYSTEM:

Theoretical/Instruction	75%
Assignments	10%
Quizzes	15%
Mid Semester Exam	25%
End Semester Exam	50%

Practical Work	25%
Lab Report	40%
Lab Quiz	30%
Lab Rubrics	30%