Course Number and Name	**CE-466-3: Water and wastewater treatment**
Credits hours	3 Credit hours
Contact hours	3 Contact hours; 3 for Lecture, 0 for Tutorial, 0 for Lab
Instructor/s name/s	Mr. Afzal Husain Khan
Textbook	H, S. Peavy, D, R. Rowe, G, Tchobanoglous, Environmental Engineering, McGraw-Hill, NY, 2013
Other supplemental materials	1. Reynolds, T. D., and P. A. Richards. Unit Operations and Processes in Environmental Engineering. 2nd ed. Boston, MA: PWS Publishing Company, 1996. ISBN: 0534948847. 2. Mara, D. Domestic Wastewater Treatment in Developing Countries. London, UK: Earthscan, 2003. ISBN: 1844070190. 3. Viessman, W., Jr., and M. J. Hammer. Water Supply and Pollution Control. 7th ed. Pearson Education, Inc., Upper Saddle River, NJ: Pearson Prentice Hall, 2005. ISBN: 0131409700. 4. Tchobanoglous, G., F. L. Burton, and H. D. Stensel. Wastewater Engineering: Treatment and Reuse. 4th ed. Metcalf and Eddy Inc., New York, NY: McGraw-Hill, 2003. ISBN: 0070418780. 5. MWH Staff. Water Treatment: Principles and Design. 2nd ed. New York, NY: Wiley, 2005. ISBN: 0471110183
Specific course information	
a. Catalog description	This class provides a various ways Water and wastewater treatment In urban environments. It will cover topics including: Water Demand - Estimation of water and wastewater quantity, population forecasting methods; water demand for various purposes; patterns in water and wastewater demand variation Water Supply/Distribution Systems, wastewater collection systems - Philosophy of treatment; Unit operations and processes; Physical, chemical and biological methods Domestic Wastewater Treatment - wastewater characteristics; primary, secondary and tertiary treatment; Physical Unit Processes - Screening; Commutation; Grit Removal; Equalization; Sedimentation; Introduction to Microbiology - Microbial ecology and Growth kinetics; Types of microorganisms; aerobic vs. anaerobic processes Biological Unit Processes - Aerobic treatment; Suspended growth aerobic treatment processes; Activated sludge process and its modifications; Tricking filters and rotating biological contactors; Anaerobic treatment; suspended growth, attached growth, fluidized bed and sludge blanket systems; Sludge Treatment - Thickening; Digestion; Dewatering; Sludge drying; Composting Wastewater Treatment Plant Characteristics - Sequencing of unit operations and processes; Plant layout; Hydraulic considerations. Natural Wastewater Treatment Systems - Ponds and Lagoons; Wetlands and Root-zone systems. Surface and Ground Water Treatment for Potable Water Supply - Water Characteristics; desalination methods, sequencing of unit operations and processes;

	Chemical Unit Processes - Coagulation-Flocculation; Filtration; Disinfections; Aeration and Gas transfer; Precipitation; Softening; Adsorption and Ion exchange; Membrane processes. The course has been presented in five chapters as below: Chapter 1: Introduction Chapter 2: Water Supply/Distribution Systems Chapter 3: Water treatment Chapter 4: Wastewater treatment Chapter 5: Advanced wastewater treatment
b. Prerequisite	CE 352
c. Required / Elective	Required

Specific goals for the course

Course Learning Outcomes (CLOs)	By the end of this course, the student will be able to: 1. To provide knowledge of water and wastewater characteristics and treatment technologies 2. To impart knowledge related to physical, chemical and biological methods of water and wastewater treatment 3. To introduce microbial ecology and theory of growth kinetics for application to biological treatment methods 4. To introduce the basic principles of sludge treatment including thickening, digestion, dewatering, sludge drying, and composting 5. To equip the students with a knowledge of natural wastewater treatment systems 6. To focus on state-of-the-art desalination techniques and their applications in arid areas with scarcity of freshwater resources 7. To enhance the student's learning experience via numerous examples and homework problems 8. To provide students with the capability to identify, formulate and solve water and wastewater engineering problems 9. To prepare students for professional practice in a field with unlimited challenges and opportunities for serving the society 10. To provide comprehensive coverage of water treatment technologies techniques that lays a foundation for lifelong learning
Student outcomes that addressed by the course	The following student outcomes are addressed by the course: SO1: Solve technical problems on wastewater treatment plants using principles of engineering, science, and mathematics. SO2: Design procedure for water and wastewater treatment units by considering economic, safety, environmental and other realistic constraints. SO3: An ability to communicate effectively with a range of audiences. SO7: An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Topics to be covered

Topic	Number of weeks
Introduction to the engineering and science principles for the design of water and wastewater treatment systems	**1,2**
Design water/wastewater treatment facilities	**3,4**
Operation and maintenance aspects of water and wastewater treatment units	**5**
MidTerm-1	**6**
Coagulation and flocculation, sedimentation, filtration,	**7**

Softening, iron and manganese taste and odor control, demineralization (RO)	**8**
Wastewater Treatment Processes: characteristics and composition of municipal wastewater,	**9**
Wastewater treatment objectives and effluent requirements/standards	**10**
Preliminary treatment (screen, shredders, grit chambers, equalization)	**11**
MidTerm-2	**12**
Primary treatment (primary clarification), secondary treatment (biological filtration, activated sludge, oxidation ponds)	**13**
Wastewater Reclamation & Reuse	**14**
Characteristics and Treatment of Water/Wastewater Sludge	**15**

Schedule of Assessment Tasks for Students During the Semester

Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	Week due	Proportion of Total Assessment
Homework	2,5,8	10%
Quizzes	3,6,9	10%
Midterm-exam I	6	15%
Midterm-exam II	12	15%
Term Project	14	20%
Final Exam	17	30%

CLO-SO Map							
	S01	S02	S03	S04	S05	S06	S07
CLO 1	√						
CLO 2	√						
CLO 3	√	√					
CLO 4		√					
CLO 5	√						
CLO 6	√						
CLO 7	√						
CLO 8	√						
CLO 9			√				
CLO 10							√