Fall 2019

Department of Civil and Environmental Engineering

CEE 370 Intro. to Environ. & Water Resources Engr.

Course Description:

With Lab. Introduction to environmental engineering with a focus on physical, chemical, and biological principles. Topics include environmental standards and legislation, material balances, reaction kinetics, environmental chemistry and microbiology, biogeochemical cycles, water quality, water resources, air quality, and solid and hazardous wastes. 4 credits

Instructor: David A. Reckhow, 3rd floor Elab II, or 16c Marston, reckhow@umass.edu
office hours: MW 11:15-12:05, F 11:15-2:15 or as posted

Pre-requisites: MATH 331 and CHEM 112

Required Textbook: Mihelcic, James R., and Zimmerman, Julie B., Environmental Engineering Fundamentals, Sustainability and Design. 2nd edition, J. Wiley & Sons Inc., 2014

Course Websites:

- Primary site: http://www.ecs.umass.edu/cee/reckhow/courses/370/
- Other: Moodle, Gradescope and Piazza

Attendance policy: Students are expected to attend all classes, labs & exams and arrive on time. They should obtain prior clearance for planned absences and notify the instructor after any emergency absences. Poor attendance or excessive tardiness will negatively affect your grade.

Academic honesty policy: Students are expected to do independent work on examinations; however, they are encouraged to work together on homework solutions, but the write-up of the solution must be their own work. Labs are normally done in small assigned groups. For more, see: www.umass.edu/dean_students/codeofconduct.

Assessment Methods (grading and instructor feedback): There will be one mid-term exam and a final exam. In addition there will be about 9 homework assignments and write-ups for each of the 5 labs. Overall course grade will be determined as follows:

Mid-term of 1-hr length	20%
Final Exam	30%
Homework Assignments/Reports	20%
Class Participation	5%
Lab Participation and Write-ups	25%

ABET COURSE PERFORMANCE INDICATORS

	Course Performance Indicators (CPIs)	Outcomes
1	I can create and apply chemical equilibrium expressions relevant to environmental systems (e.g. acid-base, precipitation, phase equilibria).	1
2	I can apply the law of conservation of mass to create mass balance equations for environmental systems (e.g., chemical dosing, quality of air or water).	1
3	I can describe the role of biological processes in environmental systems (e.g., nutrient cycles, treatment systems).	1
4	I can describe the movement of water through the hydrologic cycle.	1
5	I can identify the physical, chemical, and biological characteristics that are important for drinking water quality.	1, 4
6	I can describe why treatment of waste streams (e.g. air, wastewater, solid waste) is needed for protection of the environment and public health.	1, 2, 4, 6
7	I can perform basic environmental field and laboratory measurements and analyze resulting data.	1, 2, 3, 5, 6
8	I can define environmental engineering problems within the social, economic, and environmental context of sustainability (e.g. resource recovery from wastewater, solid waste reduction and reuse).	1, 2, 4, 7

Outcomes: Program Outcomes from ABET Criterion 3; (1-7) addressed in the course:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. 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. 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.

Additional Information:

References:

1. Davis, Mackenzie L., and Masten, Susan J., Principles of Environmental Engineering and Science. McGraw Hill, 2nd edition 2009
2. Nazaroff & Alvarez-Cohen, Environmental Engineering Science, John Wiley & Sons, Publ., 2001
3. Masters, Introduction to Environmental Engineering and Science, Prentice Hall, 2nd Edition, 1998.

4. Davis & Cornwell, Introduction to Environmental Engineering, 3rd Edition, McGraw-Hill, Inc., 1998
5. Vesilind & Morgan, Introduction of Environmental Engineering, Thomson, 2004
6. Rubin, Introduction to Engineering & the Environment, McGraw-Hill, 2001

	Topic	Approximate # classes	Chapter from Textbook
I.	Introduction overview, laws	2	1
II.	Environmental Measurements & Chemistry Units of concentration, Thermodynamics, stoichiometry, , equilibrium chemistry, kinetics, nomenclature	5	2 & 3
III.	Physical Processes Mass balances, CMFR, plug flow, energy balances, mass transport, Stokes Law, Darcy's Law	4	4
IV.	Environmental Biology Microbial growth, Pathogens, Pathways Ecosystems, Population dynamics, Biogeochemical cycles	6	5
V.	Risk Perception, Assessment, Management	1	6
VI.	Water Quantity and Quality Hydrologic cycle, Rivers, Lakes, Groundwater Water Pollutants, DO sag, Eutrophication, toxics	8	7
VII.	Water Treatment Physico-chemical treatment, biological treatment	2.5	8
VIII.	Wastewater Treatment Physico-chemical treatment, biological treatment	2.5	9
IX.	Solid Waste Engineering Quantities, recycling, landfilling	3	10
X.	Air Quality & Pollution Control Types of air pollutants, transport, control technologies	3	11

Laboratory Exercises

Laboratory Teaching Assistants:

Soon-Mi Kim (soonmi@umass.edu), Monday & Tuesday labs
Savannah Wunderlich (swunderlich@umass.edu), Wednesday & Thursday labs

Schedule (subject to change due to lab renovations)

#	Name	Instruction	**Experiment**	Follow-up
1	Stream Flow	Sept 3-5	**Sept 9-12**	Sept 16-19
2	Fluid Mechanics	Sept 16-19	**Sept 23-26**	Sept 30-Oct 3
3	Water Treatment	Sept 30-Oct 3	**Oct 7-10, 14-17**	Oct 21-24
4	Wastewater Treatment	Oct 21-24	**Oct 28-31; Nov 4-7**	Nov 11-14
5	Environmental Kinetics	Nov 11-14	**Nov 18-21**	Dec 2-5

CEE 370 labs are taught every week in 4 sections. There will be one section each day of the week (except Friday) starting at 2:30. The first meeting of each lab session (1st week of classes) and every other meeting after that will begin with a classroom-style instructional session which is likely to last only an hour. Depending on the week, this may be followed by some additional data collection concerning the previous lab. Lab 1 and 4 will also involve a field component.

Date: 8/27/2019