Chemistry 5670
Intermediate Environmental Chemistry

Instructor: Stephen Bialkowski
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Meeting: MWF 10:30-11:20, ESLC 053
Office Hours: MWF 12:00-1:00 or during the CHEM 5680 laboratory, TH 11:30-2:30

Text: Stanley E. Manahan *Environmental Chemistry* 10th Edition, CRC Press **2017** (required)

Prerequisites: Quantitative Analysis CHEM 3000/3005 Physical Chemistry, CHEM 3070 is recommended.

Course Content: This course examines the chemistry of the environment and issues of a chemical nature involved in global change. Lectures, demonstrations, and assignments are used to educate the student in current issues associated with environmental chemistry. A host of environmental problems are not confined to any one medium (air, soil, water) but are characterized by dynamic transfers among media. This interdisciplinary study of environmental chemistry aims to prepare students to understand the fundamental principles governing pollutant transport and transformation in all environmental settings.

Course Objectives: Descriptive chemistry is used to understand environmental problems associated with modern society. Particular emphasis is placed on the chemical nature of the problem and how these problems may affect our environment and the quality of our lives. The theories, models, concepts, and data analysis, as they apply to environmental degradation, will be discussed. The focus on chemistry is intended to further our limited understanding of chemical principles that, together with physical and biological processes, determine the environmental conditions in which we must find a sustainable way to live.

Lectures: The lectures will build from basic elements of air, soil, and water chemistry to enhance our understanding of problems associated with pollution from both natural and anthropogenic substances. The lecture will emphasize chemical reactions, chemical equilibrium within natural settings, transport, chemical degradation, and toxicological effects. All phases will be considered; water pollution in the hydrosphere; stratospheric ozone depletion, urban smog in the atmosphere; and soil and subterranean pollution in the lithosphere. This class will apply the principles of analytical, inorganic, organic, and physical chemistry, to the complex milieus encountered outside the laboratory.

Examinations: There will be three examinations, each worth 100 points. They will be based on the environmental chemistry of the hydrosphere, lithosphere, and atmosphere, respectively. Examination questions will be drawn from homework (out-of-class exercises, reading, and problems from the book) and concepts addressed in the lectures. Examinations are take-home format.

Homework: Reading exercises from the textbook and outside sources will be assigned. Students will be expected to find, read, and interpret articles found in the popular and scientific literature. Students will also use the internet to research topics associated with environmental pollution.

Grading: Grades are based on your performance on examinations and assignments. Point scores will be added and a percent score calculated. The guaranteed grade cut-off of 90+% A, 80%-89% B, 70%-79% C, 55%-69% D will be used ± scores will be used as prescribed in the Catalog. The percentile scores may be adjusted, only upward, to curve the percent scores *if* the examinations appear to be too difficult and if the class, as a whole, did not perform well on specific questions.

Learning Objectives:

- Be able to relate the microscopic and macroscopic properties of matter to each other
- Comprehend the importance of stoichiometry, chemical equilibrium and kinetics in analysis.
- Demonstrate knowledge of sampling methods for all states of matter
- Discuss the basic chemical components of living systems, including proteins, nucleic acids, lipids, and carbohydrates
- Apply theory and operational principles of analytical instruments
- Distinguish between qualitative and quantitative measurements and compare and critically select methods for elemental and molecular analyses
- Professional ethics

Assessment: Gain score method will be used for course effectiveness assessment. This will be part of all three take-home examinations.

Withdrawal Policy: This course will follow the University policy on withdrawals stated in the current Undergraduate Catalog. Drop dates are listed in the Spring Schedule of Classes.

Missed Examination Policy: Students may be excused from an examination in cases of emergency. Documentation to support the emergency must be supplied to the instructor. In cases of excused absence, grades will be assigned based on % of adjusted total score. No repetition of examinations is permitted.

Attendance Policy: Attendance is required for satisfactory performance.

Student Disability Statement: Any student with a disability that requires accommodations must contact the Instructor. The disability must be documented by the Disability Resource Center. Course materials may be requested in alternative formats.

Chemistry 5670 Tentative Lecture Topics

Subject	Reading
Environmental Science and Sustainability	Chapter 1
The Hydrosphere and Water Chemistry	Chapter 2
Oxidation-Reduction in Water Chemistry	Chapter 3
Phase Interactions in Aquatic Chemistry	Chapter 4
Aquatic Microbial Biochemistry	Chapter 5
Water Pollutants and Water Pollution Toxicological Chemistry	Chapter 6 Chapter 22
The Geosphere and Geochemistry	Chapter 14
Soil: Earth's Lifeline	Chapter 15
Introductory Soil Chemistry	Chapter 16
Green Chemistry	Chapter 17
Sustainable Energy	Chapter 18
Hazardous Wastes	Chapter 19
Industrial Ecology for Waste Minimization	Chapter 20
The Atmosphere and Atmospheric Chemistry	Chapter 8
Particles in the Atmosphere	Chapter 9
Gaseous Inorganic Air Pollutants	Chapter 10
Organic Air Pollution	Chapter 11
Photochemical Smog	Chapter 12
The Endangered Global Atmosphere - Global Change	Chapter 13