Chemistry 489 Advanced Environmental Chemistry
Spring 2014

GENERAL INFORMATION

Instructors: **Drs. Cielito DeRamos King and Stephen Waratuke**
Tuesday, Thursday, 11-12:15
Office hours are by appointment (or just stop by)
c2king@bridgew.edu; http://webhost.bridgew.edu/c2king/
508-531-2115 – Dr. King
swaratuke@bridgew.edu 508-531-2114 – Dr. Waratuke

Course Description: CHEM489 Advanced Environmental Chemistry (3 credits). Prerequisite: CHEM 344 and permission of the instructor. Advanced Environmental Chemistry will deal with processes for minimizing and treating solid and hazardous waste, toxicological chemistry of inorganic and organic substances, and chemical analysis of waste, water, air and solid. In addition, recent advances in the field of environmental chemistry will be discussed. The first half of the semester will be taught by Dr. King and will focus on pollution prevention and environmental chemical analysis while the second half will be taught by Dr. Waratuke and will cover organometallic catalysis with environmental applications. The course will stress assigned readings from the current literature, and assessment will be based on writing assignments, lecture exams and presentations.

Dr. King
Part 1: Pollution Prevention and Environmental Chemical Analysis
According to the EPA Americans generated about 250 million tons of trash in 2011, equivalent to 4.4 lbs of trash per person per day. This figure is about 68 % higher than the amount generated per capita in 1960. About 54% of waste ends up in landfills. Processes for minimizing and treating solid and hazardous waste will be discussed, as well as chemical analysis of waste, water, air and solids. Reading homework, classroom discussions, one lecture exam, hands-on activities and/or field work and a written research paper to be presented orally or as a poster will be required for this part of the course.

The following topics will likely be covered in this course:

1. EPA Superfund Sites and Hazardous Wastes: Background (Chapter 19, Manahan, 7th ed; http://www.epa.gov/superfund/about.htm
2. Waste Minimization, Utilization and Treatment
    a. Waste reduction and minimization
    b. Recycling
    c. Physical and chemical treatment of waste
    d. Biodegradation of waste
    e. Land treatment; In-situ treatment
3. Toxicological Chemistry of Chemical Substances
    a. Toxic elements and elemental forms
    b. Toxic inorganic and organic compounds
4. Environmental Chemical Analysis
    a. Classical methods vs. Instrumental methods
    b. Analysis of Water Samples
    c. Air Monitoring and Analysis

Useful references (not required):

1. C. Baird and M. Cann, *Environmental Chemistry*, Freeman, 2012 (5th ed.)
2. Manahan, Stanley E. "Environmental Chemistry," (9th or earlier ed.) Lewis, 2009.

GRADING POLICY (Dr. King)	**% of final grade**
▪ Contributing to class discussion & attendance	15 %
▪ Homework (3-4)	20 %
▪ Exam (1 Final)	40 %
▪ Written/Oral Report	25 %
TOTAL	**100%**

NOTE: Your final course grade will be based on 50 % of your grade in my class and 50 % in Dr. Waratuke's.

Attendance policy: I expect you to attend *100 % of my lectures*. Attendance will be taken during each meeting. You are responsible for obtaining missed lecture notes and assignments. Points will be taken off of your final grade after you missed more than one class, unless a valid excuse is presented.
Tardiness: Please do not come to class if you are late *for more than 10 minutes*, as latecomers disturb my concentration.

Homework: Homework will be assigned and collected approximately once every week or two. They are usually based on current or future lecture topics. While group discussion of homework questions is acceptable, ***copying from one another is totally unacceptable*** as it is a form of ***cheating***. I reserve the right to assign a grade of zero for identical homework. Late work will incur a penalty proportional to the number of days they are late. Once a homework/problem set has been graded and returned, late ones won't be accepted anymore and will be assigned a grade of zero.

Useful Web Sites:

Municipal solid waste

http://www.epa.gov/epawaste/nonhaz/municipal/ and http://www.epa.gov/epawaste/nonhaz/municipal/pubs/MSWcharacterization_508_053113_fs.pdf
http://www.mass.gov/eea/agencies/massdep/recycle/

Hazardous waste

http://www.epa.gov/epawaste/hazard/

Local Superfund Sites

http://www.epa.gov/region1/superfund/index.html

Individual Report and PowerPoint Presentation: (TBA) Each student will be assigned a topic to research. The topic will be limited to the chemical analysis of waste, specific pollutants or other chemicals of interest. You will be asked to present your findings towards the end of the semester. PowerPoint presentations will be approximately 20 minutes long, plus 5 minutes of Q&A. A 5- to 8-page written report must accompany your oral presentation. The format for the report will be discussed later.

"Final Exam": The material on the exam will be taken directly from our class discussions, homework, hands-on activites and/or field work, lecture handouts and student presentations. If you miss the "final exam", you must contact me by phone or email within 2 hours of the missed exam. Upon receipt of a written, verifiable excuse, you may be given a make-up exam at my discretion. ***Illness requiring a doctor's care or personal emergencies are the only acceptable excuses.*** All other excuses will result in a zero exam grade. Make-up exams are given within 48 hours of the scheduled exam date.

Part 2: Organometallic Catalysts with Environmental Applications

Dr. Waratuke; swaratuke@bridgew.edu; CON 413; 508-531-2114
Office Hours: TBA or anytime you can find me

Part 2 of this course will be taught like a graduate level survey on environmental organometallic catalysis. To the best of my knowledge, a course like this has not been taught before and certainly no book yet exists. The goal of this course is for each of you to learn and explore how recent advances in catalysis have been able to take into account environmental concerns while still improving the general aspects of catalytic systems. The topics that will be presented in this course will try to span a range of industrial processes that use catalysts, how these catalytic processes work chemically, and how they have been "improved upon or need to be improved upon".

Much of the direction of our discussions and the course as a whole will depend upon the interests each of you have towards the various readings and catalytic processes. The quizzes will aide your preparation to discuss the assigned articles in class. The take home exam will be a test of your understanding of these discussed points. The pinnacle piece will be a literature project focusing on a catalytic system of your choice. Your in-depth look at the system should enable you to gain a strong understanding of this topic and present your paper to the class. I hope that this will be a rewarding and fun learning experience for each of you.

Grading system and additional information about this second half will be provided later.