CE396L.4 - Indoor Air Quality: Physics & Chemistry

Unique #: 16075 Fall 2013
Room: ECJ 5.418 Time: 12:30 to 1:45 p.m.

Instructor Information

Professor: Richard L. Corsi, Ph.D., P.E. **Office**: ECJ 9.102H

Phone: **Email:**

Office Hours: T Th 2:30 to 4:30 p.m. (or by appointment) **Twitter**: @CorsIAQ

Pre-requisites

Pre-requisites: Graduate standing with an undergraduate degree in Environmental, Civil, Chemical, or Mechanical Engineering, or consent of instructor. Qualified undergraduate students may enroll with consent of instructor.

Computer: Proficiency with computers and familiarity with a spreadsheet program is expected.

Textbook & Reading Assignments

Text: There is not a text book for this course.

Reading Assignments: Required reading materials or references to journal papers available on-line will be provided to students during the semester. Students will be responsible for reading approximately 10 journal articles during the semester, in addition to papers reviewed as part of a term project.

General Course Overview

Course Topics: A list of course topics with weeks of coverage is provided at the end of this syllabus.

Academic/Learning Goals: The objectives of this course are to (1) familiarize students with the broad field of indoor air quality, (2) familiarize students with specific indoor air pollutants and their sources, particularly as related to gaseous pollutants, (3) provide students with an understanding of the physical and chemical processes that affect the fate of gaseous indoor pollutants, including physical adsorption and both homogeneous and heterogeneous chemical reactions, (4) provide students with intellectual tools that will allow them to predict the levels, fate, and potential impacts of gaseous pollutants in buildings, and (5) allow students to gain additional insights regarding specific topics related to indoor air quality through a rigorous term project. Assessment of these academic/learning goals is described in more detail below.

Course Format: Lectures will be supplemented by a substantial term project. Outside reading assignments, homework assignments and exams will also be used to supplement lecture material.

Assessment of Academic Learning Goals

Attendance: Regular attendance is highly recommended and expected. However, attendance will not be taken for purposes of grading.

Homework: Homework will be assigned in lecture and posted on the course Blackboard site. Approximately 5 to 7 homework assignments will be assigned during the semester.

Mid-Term Exams: There will be two exams in this course. Both will be take-home exams given on Tuesday and will be due back at the beginning of lecture on the following Thursday. Exams will be distributed on October 8th and November 12th.

Final Exam: Pending administrative approval, a final exam will not be given in this course.

Term Project: Depending on class size, students will work on either individual or team projects to investigate any one of several topics relevant to the course. Students will be able to choose from a list of topics provided by the instructor, or may propose their own topic with permission from the instructor. Responsibilities will include a rigorous study of the topic (including a review of existing literature), an oral presentation to classmates at the end of the semester, and a journal manuscript that conforms to the requirements of the journal *Indoor Air*.

Depending on class size, presentations will be made during the last week of the semester at our regular meeting time or during one evening.

Students are expected to integrate course material to complete the term project, and to demonstrate a firm understanding of project materials as reflected in final written and oral presentations.

Component Weighting and Grading Policy

A +/- grading system will be used to assign final grades in this course.

Basis of grading in this course:

* Homework	20%
* Exam 1	25%
* Exam 2	25%
* Term Project	30%

Letter grades will be assigned as follows:

* A	93 – 100%
* A-	89 - 92%
* B+	86 – 88%
* B	82 - 85%
* B-	79 - 81%
* C+	76 – 78%
* C	70 – 75%
* C-	67 - 69%
* D+	64 – 66%
* D	58 – 63%
* D-	55 – 58%
* F	< 55%

Teaching Assistant

A teaching assistant is not assigned to this course.

Tutorial Plan

This course will not have tutorials. Students are encouraged to attend assigned office hours or to make an appointment with the professor to discuss general course concepts, the indoor air quality field, reading assignments, homework assignments, exams, or term project.

Course Materials on Blackboard

Course materials will be posted on the CE396L.4 electronic *Blackboard* site throughout the semester. These materials will include the course syllabus, supplemental material for lectures, homework assignments and solutions, special announcements, and other relevant course materials. Students should become familiar with the CE396L.4 *Blackboard* site.

Students with Disabilities

The University of Texas at Austin provides upon request appropriate academic accommodations for qualified students with disabilities. For more information, contact the Division of Diversity and Community Engagement, Services for Students with Disabilities, 512-471-6259 (voice) or 512-410-6644 (video phone) or http://www.utexas.edu/diversity/ddce/ssd.

Access to Computers

All students registered in this course must have an email account. You may use your existing account or you may obtain a University email account. I will be communicating via email on a frequent basis with the class.

The Department of Civil Engineering has a microcomputer laboratory, the Learning Resource Center (LRC) on the third floor of ECJ. The LRC is available for you to use. Assistants in the LRC are there to operate the microcomputer laboratory and to respond to specific software and hardware problems.

Course/Instructor Evaluation Plan

During one of the two final meeting periods of the semester students will have an opportunity to evaluate this course and the instructor using approved MEC forms. These forms will be distributed and collected by a student in the class. The instructor will not be present when the forms are being completed. All students are encouraged to attend this meeting and to complete the MEC forms**.** *Students are encouraged to speak with the instructor during the semester, and to provide feedback regarding the course. This is a sincere statement (your input is important to me).*

Scholastic Dishonesty Policy

A great education is one that involves personal growth and deep intellectual exploration experienced and performed with academic integrity and honesty. A failure on the latter is a failure to one's self, fellow students, and to the academic institution. Thus, students who violate University rules on scholastic dishonesty are subject to disciplinary penalties, including the possibility of failure in the course and/or dismissal from the University. Policies on scholastic dishonesty will be strictly enforced. For further information, visit the Student Judicial Services web site http://www.utexas.edu/depts/dos/sjs/.

Instructor Absences

Dr. Corsi may be absent from one to three lectures during the semester. These dates will be specified in advance. Guest lecturers will fill in for Dr. Corsi during any absences

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Privacy

Web-based, password-protected class sites may be associated with all academic courses taught at the University. Syllabi, handouts, assignments and other resources are types of information that may be available within these sites. Site activities could include exchanging email, engaging in class discussions and chats, and exchanging files. In addition, electronic class rosters will be a component of the sites. Students who do not want their names included in these electronic class rosters must restrict their directory information in the Office of the Registrar, Main Building, Room 1. For information on restricting directory information, see the Course Schedule, Undergraduate Catalog or go to: http://www.utexas.edu/student/registrar/catalogs/gi00-01/app/appc09.html.

Some Additional Information

Undergraduate Students- drop policy for long sessions: From the 1st through the 12th class day, an undergraduate student can drop a course via the web and receive a refund, if eligible. From the 5th through the university's academic drop deadline, a student may Q drop a course with approval from the Dean, and departmental advisor.

Graduate Students- drop policy for long sessions: From the 1st through the 4th class day, graduate students can drop a course via the web and receive a refund. During the 5th through 12th class day, graduate students must initiate drops in the department that offers the course and receive a refund. After the 12th class day, no refund is given. **No class can be added after the 12th class day.** From the 13th through the 20th class day, an automatic Q is assigned with approval from the Graduate Advisor and the Graduate Dean. From the 21st class day through the last class day, graduate students can drop a class with permission from the instructor, Graduate Advisor, and the Graduate Dean. **Students with 20-hr/week GRA/TA appointment or a fellowship may not drop below 9 hours.**

Religious Holy Days: A student who misses classes or other required activities, including examinations, for the observance of a religious holy day should inform the instructor as far in advance of the absence as possible, so that arrangements can be made to complete an assignment within a reasonable time after the absence."

TOPIC OUTLINE

Module 1. Introductory Concepts **Week 1**

- Historical perspective and importance and impacts of indoor air quality
- Comparison of indoor and outdoor atmospheres
- Indoor air physics and chemistry: overview of key components
- Institutional framework
- Some important indoor air pollutants

Module 2. Fundamental Principles **Weeks 2-3**

- Indoor air as an ideal gas / Units of measurement
- Reactor models
- Important parameters
- Buildings as physical and chemical reactors

Module 3. Adsorption/Desorption Processes **Weeks 4-5**

- Conceptual development
- Equilibrium conditions
- Sorption kinetics: non-porous materials
- Sorption kinetics: porous materials
- Some experimental findings
- Implications with respect to control

Module 4. Heterogeneous Indoor Chemistry **Weeks 6-7**

- Conceptual development
- Deposition velocity
- Deposition theory
- Reaction probability
- Some observed by-products of heterogeneous reactions
- Implications with respect to control

Module 5. Homogeneous Indoor Air Chemistry **Weeks 8-9**

- Ozone chemistry with reactive VOCs
  - Basic concept + sources of ozone
  - Reactive VOCs and their sources
  - Reaction kinetics and analysis of time scales
  - By-products
- OH* Chemistry
  - OH* formation chemistry
  - OH* reaction concepts
  - OH* consumption kinetics
  - Some by-products
- NO3* chemistry
  - NO3* formation chemistry
  - NO3* reaction concepts

Module 6. Special Topics (building disinfection chemistry, green buildings, etc.) **Weeks 10+**