

CE 5326 AIR POLLUTION CONTROL

Spring 2020

Class Reference Number: 25138
Class Meeting: 4:30 PM - 5:50 p.m., TR
Class Room: C 204
Textbook:
Air Pollution Control Engineering, 2nd edition
by Noel De Nevers
Atmospheric Chemistry and Physics
by J.H. Seinfeld and S.N. Pandis

Instructor: Wen-Whai Li, Ph.D., P.E., Q.E.P.
Professor of Civil Engineering
Office: A211
Phone: 747-8755
Office Hours: 1:00 p.m. - 2:00 p.m., TR

Course Description

The primary objective of this course is to provide the students an overview of the field of air pollution. The course will cover topics that are pertinent to the study of air pollution, such as air pollution meteorology, sources of pollution, pollutant fate and transport, effects of air pollution, ambient air monitoring, and pollution abatement. Regulatory models currently available for estimating pollutant emissions and air concentrations will be presented and discussed in the class.

Instructor's notes and excerpts from several reference books will be distributed in the class to supplement the topics discussed in the textbooks. Students are required to read the assigned chapters, classnotes, and excerpts prior to the class meeting. A list of the reference books is presented in this syllabus and additional references will be given in the class during the semester. Final grade will be determined based on the student's performance in homework, quizzes, and exams.

Grades

Your grade for this course will be assessed based on your performance in the quizzes (25 %), 3 mid-term exams (55 %), and homework (20 %). Several quizzes will be given throughout the semester. The content of a quiz could be the materials covered in previous sessions or to be covered that day. Your lowest quiz will not be counted toward your final grade. There will be no make-up quizzes. Three exams will be given during the semester. Students are required to take all three exams. Make-up exams will be given only for extremely credible reasons.

Your final grade will be calculated based on the points you have accumulated as follows:

A ≥ 90
B ≥ 80 but < 90

C	≥ 70 but < 80
D	≥ 50 but < 70
F	< 50

Attendance of the class is mandatory. **Your final grade will be downgraded one notch (i.e., from “A” to “B” or from “B” to “C”) if you miss more than three classes without the instructor’s consent. You will be drop off the course if you missed more than 4 classes.**

The instructor reserves the right to revise this grading plan. However, students will be informed of any changes during the semester.

Homework

Regular homework assignments will be used to reinforce the concepts and problem-solving techniques covered in the textbooks and class. Homework will be assigned in class. All homework will be graded. Homework should be neatly presented on engineering paper or equivalent. You may be asked to present your homework solutions in class. Late homework will only be accepted in the event of illness or an emergency and must be approved by the instructor.

Instructor’s Office Hour

During the specified office hours, you can drop in my office for any questions regarding the subjects discussed in the class without making an appointment. Of course, you are always welcomed to visit me at any other times, but I may not be available for discussion because of other commitments. Leave me a note, call for an appointment, or send me an email will be the most effective way to catch me for your questions. Remember, do not pile up questions and expect me to answer all your questions the day before an exam.

Class Schedule

Week	Date	Topic	Reading Assignments
1	1/21 1/23	<u>Introduction to Air Pollution:</u> The history of air pollution, problems of air pollution, air pollutants and associated health effects, air concentrations.	DN: Chap. 1 Arya: Chap. 1 SP: Chap. 1.7
2	1/28 1/30	<u>Elements of Air Pollution:</u> Impacts of air pollution on social, economic, environment, health, and other issues <u>Atmospheric Pollutants:</u> Vapors and particulate, atmospheric pollutants categorized by chemical compounds, HAPs.	DN: Chap. 2 SP: Chap. 2
3	2/4 2/6	<u>Atmospheric Pollutants: (Continued)</u> <u>Effects of Air Pollution</u> <u>Air Pollution Control Law and Regulations</u>	DN: Chap. 2, 3
4	2/11 2/13	<u>Air Pollution Measurements:</u> Ambient air sampling of PM and VOCs, sampling and siting criteria, data analysis <u>Emission Monitoring:</u> Emission inventory, emission modeling, application of EPA emission models.	DN: Chap. 4
5	2/18 2/20	<u>The Atmosphere:</u> Layers of the atmosphere, atmospheric circulation, water vapors in the atmosphere, Coriolis force, atmospheric air movements. <u>The Atmospheric Boundary Layer:</u> Structure of the atmospheric boundary layer, geostrophic winds, velocity profile, turbulence, building wakes, equation of motion. EXAM #1	DN: Chap. 5 SP: Chap. 1 Arya: Chap. 2
6	2/25 2/27	<u>Air Pollution Meteorology:</u> Pressure and temperature in the lower atmosphere, atmospheric stability, temperature inversions.	DN: Chap. 5, 6 SP: Chap. 14
7	3/3 3/5	<u>Air Pollution Meteorology</u> <u>Pollutant Transport and Diffusion:</u> Eulerian and Lagrangian approaches, Gaussian plume dispersion model, application of Gaussian models, plume rise, and building wakes.	DN: Chap. 5, 6 SP: Chap. 17
8	3/10 3/12	<u>Air Pollution Modeling:</u> Application of EPA regulatory models: SCREEN3, (AERMOD)	DN: Chap. 5, 6 SP: Chap. 17

9	3/17 3/19	Spring Break (No Class) Spring Break (No Class)	
10	3/24 3/26	<u>Air Pollution Modeling:</u> Application of EPA regulatory models: SCREEN3, AERMOD	DN: Chap. 6
11	3/31 4/2	EXAM #2 <u>Air Pollution Control:</u> Air quality criteria and standards, air pollution control philosophies, air pollution regulations.	DN: Chap. 7 DN: Chap. 8
12	4/7 4/9	<u>Particulate Pollution Control:</u> Principles of PM pollution control, PM pollution control technologies	DN: Chap. 9
13	4/14 4/16	<u>Particulate Pollution Control</u> <u>Control of Gaseous Pollutants</u> controls of VOC, controls of mobile source emissions	DN: Chap. 10, 15
14	4/21 4/23	<u>Control of Gaseous Pollutants</u> <u>Atmospheric Chemistry:</u> Atmospheric photochemistry and chemical kinetics, chemistry in the troposphere.	DN: Chap. 11
15	4/28 4/30	<u>Atmospheric Chemistry (Continued)</u> <u>Motor Vehicle Problems</u> <u>Indoor Air Pollution:</u> Indoor air pollutants, indoor air exposure pathways, indoor air quality models.	DN: Chap. 13
16	5/5 5/7	<u>Urban Air Pollution:</u> Characteristics of urban air pollution, box model, photochemical air quality models, control of urban air pollution	
17	5/12	EXAM #3 (4:00-6:45 pm, tentative)	

DN: Air Pollution Control Engineering, 2nd edition

SP: Atmospheric Chemistry and Physics

Arya: Air Pollution Meteorology and Dispersion

References

- S. Pal Arya. 1999. *Air pollution meteorology and dispersion*.
R. P. Turco. 1997. *Earth Under Siege*.
A. J. Buonicore and W.T. Davis. 1992. *Air pollution engineering manual*
G.T. Csanady. 1980. *Turbulent diffusion in the environment*
C.D. Cooper and F.C. Alley. 1990. *Air pollution control - A design approach*
W. C. Hinds. 1999. *Aerosol Technology: Properties, behavior, and measurement of airborne*

particles

- S.R. Hanna, G.A. Briggs and R. P. Hosker Jr. 1982. *Handbook on atmospheric diffusion*
- R.W. Longley. 1970. *Elements of meteorology*
- R.W. Longley. 1970. *Elements of meteorology*
- J.R. Holton. 1992. *Introduction to Dynamic Meteorology*
- H. Schlichting. 1979. *Boundary layer theory*
- D.H. Slade (Editor). 1968. *Meteorology and atomic energy*
- D.B. Turner. 1994. *Workbook of atmospheric dispersion estimates: An introduction to dispersion modeling*
- U.S. EPA. 1980. *APTI Course 435 Atmospheric Sampling*
- U.S. EPA. 1995. *ISC3 Users Manual*
- U.S. EPA. 1996. *Guideline on air quality models*
- K. Wark, C.F. Warner and W.T. Davis. 1998. *Air pollution - Its origin and control*