UNIVERSITY OF CALIFORNIA
UCMERCED

Syllabus for ES234: Air Pollution and Resources

Fall 2017
Instructor: Wolfgang Rogge, Ph.D., P.E.

Designation: ES234

Credit: 3 Credits

Catalog Description: Atmospheric sciences and meteorology; chemistry of air pollutants and its fate; gas-to-particle conversion; nucleation and coagulation of aerosol; oxidizing power of the troposphere; ozone pollution; wet and dry pollutants deposition; air quality modeling; global climate change; impact on human health and natural environment.

Text Books: (1) INTRODUCTION TO ATMOSPHERIC CHEMISTRY by Daniel J. Jacob, published by Princeton University Press Princeton, New Jersey, 1999.

(2) Handouts and Notes

Course Objectives:

1) To provide students with substantial science and engineering knowledge necessary to understand air pollution formation, release, transformation, dispersion, and potential health impacts; 2) to demonstrate how that knowledge together with mathematics and modeling tools are applied to solve air pollution problems; and 3) to enable the students to formulate problems and subsequently design solutions to air pollution problems using assumptions based on scientific and engineering methods and tools.

Student Learning Outcomes:

Considering local and global air pollution problems and national requirements as well as international agreements on pollution control, students will be able to determine necessary emission reductions to prevent harm to occur to human health, welfare, the natural environment, and climate. By the end of the course through lectures, problem solving in supervised class meetings, homeworks, readings, presentations, and exams:

- The students will have demonstrated skills to formulate and solve often complex

air pollution problems, understand the potentially different chemical avenues alternative chemical pollutants will take. Be able to vary study outcomes by varying assumptions to complex atmospheric chemistry issues.

- Students will be able to develop and apply mathematical models to predict the atmospheric chemical transformation of pollutants as well as horizontal and vertical transport throughout the troposphere and stratosphere and exchange between the hemispheres.
- Students will become proficient to process, analyze, and interpret air pollution and meteorological data and to apply scientific methods and environmental science and engineering strategies that help to promote a more sustainable and healthy environment.
- Further, they will be able to discuss knowledge gaps that require more advanced studying and the need for additional future research. Their communication skills will improve through discussions and presentations.
- Additional proficiency will be obtained by a state-of-the-art individual semester long project that covers problem(s), assumption(s), and solution(s) to a current air pollution issue; and, they will obtain an appreciation for the complexity and importance of air pollution problem solving.

The aforementioned student learning outcomes relate to the first three program learning outcomes listed below.

Program Learning Outcomes:

The overarching goal of the Environmental Systems program is that its graduates be knowledgeable and professionally competent in one or more areas of environmental systems. The following program learning outcomes are being used to attain this goal:

- ***Core Knowledge -*** Graduates will be knowledgeable, skillful and self-directed in the observation and analysis of environments systems in terms of their capacity to independently identify important research questions, formulate experimental plans, data analysis and formulation of conclusions in the context of a doctoral dissertation.
- ***Communication Skills -*** Graduates will be conversant in at least two areas of environmental systems, and be adept at oral, written and visual communication of research results to peers and non-technical decision makers.
- ***Ethics, Community, and Life-long Learning -*** Graduates will understand the importance of research and professional ethics, engagement in the needs of their community and life-long learning.
- ***Career Placement and Advancement -*** Graduates will find suitable career placement and achieve advancement in government agencies, non-government organizations, private industry, and/or academic teaching and research institutions.

Prerequisites by Topic: EnvE20 or permission of instructor

Course Policies:

a) Course setup: There will be traditional lectures mostly based on book (1) INTRODUCTION TO ATMOSPHERIC CHEMISTRY by Daniel Jacob.

b) Attendance and Participation: It is imperative that you avoid missing classes, be on time and participate. Attendance will be monitored during each meeting and amount to a maximum of 5% of the grade.

c) Readings: Our textbooks are mostly excellent. For the success of interactive learning and problem solving, it is paramount that you come to class prepared and ready to ask questions on whatever you might not have understood in the book chapter.

d) In-class student problem solving: In order to facilitate learning, supervised independent learning and in-class exposure to problem solving are very helpful. Consequently, I will demonstrate example problems together with you in class. Similarly, you will be giving a problem to be solved in-class by either all students individually or in groups. During in-class problem solving, you will have the opportunity to ask questions and request my assistance. For longer problems, you will be asked to finish a given problem at home and one student will be randomly picked to solve the problem on the board during the next time.

e) Assignments: Homework assignments will consist of 6 to 10 problems each and are due on set day at the very beginning of the class. Late homework will not be accepted, receiving zero points. Your homework must be an individual effort, unless otherwise indicated. Begin your homework as soon as it is assigned. Problems will not be graded, rather credit will be provided for each completed homework problem handed in on time. The solution to the homework will be posted on CatCourses after all homeworks are obtained. It is your responsibility to compare the solution provided with your homework. Please do not hesitate to ask me if you feel that you do not understand the solution. Begin your homework as soon as it is assigned. The homework has to be done in a professional fashion e.g. text program or very well hand written. Homework that lacks readability and professional setup will be returned receiving zero points. Each problem should be exactly labeled with the number used in the book, problem stated, approach to solve problem shortly summarized, and all partial and/or final results clearly labeled.
The solution to the homework will be posted on CatCourses after all homeworks are obtained. It is your responsibility to compare the solution provided with your homework. Please do not hesitate to ask me if you feel that you do not understand the solution.
The homework has to be done in a professional fashion e.g. text program or very well hand written. Each problem should be exactly labeled with the number used in the book, problem stated, approach to solve problem shortly summarized, and all partial and/or final results clearly labeled.

f) Web Site: PowerPoint presentations, homework assignments and solutions as well as important announcements (deadline changes, exam dates, etc.) will be posted on the course web site. It is important that you get comfortable with using this system early in the semester.

g) Cell phones: Please turn off cell phones and pagers before entering the classroom. Cell phone usage during exams and tests automatically invalidates the test or exam, receiving zero points. Please, no texting or emailing during class!

h) Final Project: A final project is required that is substantial in length and in depth, covering a current important topic of air pollution and/or climate change research. This project has to be presented in a presentation to the class and should be about 30 min. long. In addition, a written report of at least 30 pages plus citations is required.

Academic Dishonesty Statement:

a) Each student in this course is expected to abide by the University of California, Merced's Academic Honesty Policy. Any work submitted by a student in this course for academic credit will be the student's own work.

b) You are encouraged to study together and to discuss information and concepts covered in lecture and the sections with other students. You can give "consulting" help to or receive "consulting" help from such students. However, this permissible cooperation should never involve one student having possession of a copy of all or part of work done by someone else, in the form of e-mail, an e-mail attachment file, a diskette, or a hard copy. Should copying occur, both the student who copied work from another student and the student who gave material to be copied would both automatically receive a zero for the assignment. Penalty for violation of this Policy can also be extended to include failure of the course and University disciplinary action.

c) During examinations, you must do your own work. Talking or discussion is not permitted during the examinations, nor may you compare papers, copy from others, or collaborate in any way. Any collaborative behavior during the examinations will result in failure of the exam, and may lead to failure of the course and University disciplinary action.

Disability Statement:

Accommodations for Students with Disabilities: The University of California Merced is committed to ensuring equal academic opportunities and inclusion for students with disabilities based on the principles of independent living, accessible universal design and diversity. I am available to discuss appropriate academic accommodations that may be required for student with disabilities. Requests for academic accommodations are to be made during the first three weeks of the semester, except for unusual circumstances. Students are encouraged to register with Disability Services Center to verify their eligibility for appropriate accommodations.

Topics:

Measures Of Atmospheric Composition
Atmospheric Pressure
Simple Models

Atmospheric Transport
Air Pollution in Cities
Geochemical Cycles
Aerosols, formation & conversion, health impact
The Greenhouse Effect
Chemical Kinetics
Stratospheric Ozone
Oxidizing Power of The Troposphere
Ozone Air Pollution

Class/laboratory Schedule: MW 15:30 - 17:20 in CLSSRM-114

Exams Schedule:

Midterm: Will be a "group take-home" exam. At least two students and not more than three students have to work as a group on the midterm. Per group, only one midterm exam is allowed to be handed in on set date. No one-student (individual) midterm exam will be accepted! Start early to assemble a team! There will be one week to solve the exam. The midterm exam has to be typed. No handwritten exam will be accepted! This exam is long; therefore, meet with your group frequently and develop a group work and assignment plan early on.

Final Exam: Will be a "group take-home" exam. At least two students and not more than three students have to work as a group on the exam. Per group, only one exam is allowed to be handed in on set date. No one-student (individual) midterm exam will be accepted! Start early to assemble a team! There will be one week to solve the exam and it is due at the last day of class. The exam has to be typed. No handwritten exam will be accepted! This exam is shorter than the midterm; but, nonetheless, meet with your group frequently and develop a group work and assignment plan early on.

Assessment/Grading Policy:

Mid-term exam: 25%;
Final exam: 25%;
Project: 35%;
Homework: 10%;
Attendance: 5%.

Coordinator: Wolfgang Rogge, Ph.D., P.E.

Contact Information:

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Office Hours: MW 14:00-15:00, or right after class, or by appointment.