UNIVERSITY OF CALIFORNIA
UCMERCED

Syllabus for ENVE130: Meteorology and Air Pollution

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

Designation: EnvE130

Credit: 4 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) AIR POLLUTION AND GLOBAL WARMING Mark Z. Jacobson Second Edition Cambridge Press ISBN 978-1-107-69115-5

(3) 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 and subsequently design solutions to air pollution problems using 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 and stating the assumption applied.
- Students will be able to develop and apply simple 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 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 possibly future research. Their communication skills will improve through discussions and individual project presentations; and, they will obtain an appreciation for the complexity and importance of environmental engineering.

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

Program Learning Outcomes:

(1) Ability to apply knowledge of mathematics, science, and environmental engineering (ABET a)
(2) Become proficient to process, analyze, and interpret air pollution data (ABET b)
(3) Derive simple 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 (ABET e)
(4) Describe and explain major state and federal air quality rules and laws, as well as international treaties and given violations of the aforementioned decide on the best course of action and justify the decision (ABET f)
(5) Be able to critique oral project presentations and identify both strength and areas for improvement and write an effective reports to communicate to engineering peers (ABET g)
(6) Achieve understanding of the complexity of air pollution issues and identify possible negative local, global and/or societal consequences and be able to recommend solutions to minimize or avoid those (ABET h)
(7) To find and select relevant sources of information about the project topic in the library and on the World Wide Web (ABET i).

Prerequisites by Topic: EnvE20 or ESS20

Course Policies:

a) Course setup: There will be traditional lectures mostly based on book (1) INTRODUCTION TO ATMOSPHERIC CHEMISTRY by Daniel Jacob. Because the chapter on aerosol is rather limited, additional material will be provided to substantially extend the knowledge on atmospheric aerosol. Furthermore, two sets of 3 to 4 students are

asked to prepare a 10 min presentation (PowerPoint) plus up to 1 min for setting up for each meeting about a section/chapter in book (2) AIR POLLUTION AND GLOBAL WARMING by Mark Z. Jacobson, see schedule provided separately. During each meeting we will have two presentations from two sections in the book. Randomly, one student for each of the two sections will be selected to present each a 10 +1 min talk, followed by 3 min of questions and answers each. Do prepare your presentation well! Due to time constrains, each student will have exactly only 10 min. to present! Your presenting grade will also consider if you are able to finish within the given time, including setting up. So, have your computer and presentation ready! All students are required to upload their PowerPoint presentation to CatCourses and will obtain points for the quality of the PowerPoint presentation (each student) and for the oral presentation (presenting student only). At least one day (24h) before the each class, there will be a multiple-choice test available through CatCourses that has to be taken online. Each test will cover the section/chapter assigned for presentations for a given date. All students have to take the online tests. The tests are timed and can only be taken one time! So, be ready to take the test before you sign on! For ABET purposes and continuous learning "old questions" from prior tests, may be asked again. So, if you know that you answered a question wrong, please revisit the book and learn the respective material.

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. Even if not explicitly advised, you are responsible to read ahead so that you are prepared for the next class meeting. There will be an online multiple-choice quiz for each section (AIR POLLUTION AND GLOBAL WARMING Mark Z. Jacobson) assigned as student presentation. So, each student is required to read the respective section and take the online multiple-choice test before coming to class.

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.

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!

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 assignments. 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 GLCR165

Online Tests and In-class Exams Schedule:

There will be an online multiple choice quiz for each scheduled day (AIR POLLUTION AND GLOBAL WARMING Mark Z. Jacobson) of the two presentations. So, all students of this course are required to read the respective sections and take the online multiple-choice test before coming to class. This online test is open for at least for 24 hours (from noon to noon). Each of these multiple-choice tests can only be taken one time and when an answer is selected, this cannot be changed anymore.

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:

Chapter Presentations (Mark Z. Jacobson's Book): 15%;
Online multiple-choice tests: 20%;
Mid-term exam: 25%;
Final exam: 25%;

Homework: 10%;
Attendance: 5%.

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

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Office Hours: Tues & Thursdays: 14:00-15:00, or right after class, or by appointment.

Teaching Assistant: Shirin Mehrazi

Contact Information:

smehrazi@ucmerced.edu

Shirin will grade your homeworks (one or zero point system for each problem) and will grade your presentations as well as powerpoints.

One point: Correct answer, incorrect answer but looks as if you really tried to solve the problem.

Zero point: Not attempted to solve problem, started but not completed, only a bit of bla bla.