A. JAMES CLARK
SCHOOL OF ENGINEERING

Fall 2019 ChBE 472 & ENCH 648C: Air Pollutions Sources and Control

Instructor: Dr. Akua Asa-Awuku
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Guest Lecturers: Dr. Qi Yao and *TBD*

Course TA: Kanishk Gohil E-mail: mailto:kgohil@terpmail.umd.edu
Office Hours: Friday at 1-3pm (Location, TBD)

Lessons: MW 1:00pm - 2:15pm. TLF 1103
Final Exam: Take Home Exam Due: **TBD**
Website/Blackboard/Canvas: www.elms.umd.edu

Course Reading Materials: No Required Textbook

Reserved Reading & Handouts: weekly (uploaded to Canvas)

1. Original journal pee-reviewed articles related to the air pollution sources and control
2. Supplemental materials from EPA's Air Pollution Training Institute
3. Perry's Chemical Engineering Handbook (electronic book)

Specific Course Information:

Prerequisites: none (some calculus and general chemistry and physics will be useful)

Description: Sources and effects of air pollutants, regulatory trends, atmospheric dispersion models, fundamentals air pollution control systems, design of systems for control of gases and particulate matter.

Emphasis: The course emphasizes the application of fundamental chemical engineering principles (mass and energy balances, thermodynamics, kinetics, dispersion, mass transfer) to air quality engineering and control. While a differential equations based approach is needed for some topics, there will be considerable emphasis on scaling behavior and dimensional analysis and the design of models applied to atmospheric systems.

Course Overview:

This course will focus on developing a fundamental understanding of the sources of air pollution and subsequent control. By the end of the course, students will be able to communicate federal and state air pollution policies, identify sources of air pollutants and strategies to classify and mitigate emissions. Students will also be able to identify critical air pollutants including sulfur, nitrogen and carbon containing species, photochemical oxidants, halogen containing compounds and air toxics. In addition, the dispersion and transport of pollutants will be discussed; thus the vertical profile, vertical mixing, and temperature and meteorological effects will also be discussed. Students will develop chemical kinetic expressions to describe atmospheric chemistry, in particular the photo stationary state to describe basic VOC-NOx interactions and their impact on ozone formation. By the end of the course, students should be able to a) estimate ambient concentrations from point sources b) use simple atmospheric box models to predict ambient concentrations fate and transport and c) estimate wind variation with altitude and plume rise and d) account for ground reflection, inversion heights, and multiple sources. In addition students will be exposed to the sources and controls for atmospheric pollutants. Specifically, students will gain familiarity with terminal settling velocities, particle removal efficiencies, sulfur and nitrogen removing strategie, and pollutant reduction methods. Lastly, we will address current air pollution and

global air quality issues and discuss causes of global climate change and potential atmospheric implications. *Expect lots of in-class discussions!*

Objectives:
The objective of this course is to develop communication and fundamental technical skills that will facilitate the application of students' mathematical, scientific, and engineering skills to analyze and interpret environmental air pollution/ Students will:

- Understand fundamental sources of air pollution and subsequent engineering control and apply this knowledge to engineering research and practice.
- Improve one's ability to properly interpret and analyze air pollution data and control mechanisms.
- Develop a working knowledge of data collection and experimental practices in regards to air pollution concentrations, toxics, and the experiments in terms of data collection.
- Use Critical Thinking skills to understand the ethical obligation of an engineer to apply air pollution knowledge and control applications for research and policy design.
- Improve communication skills via classroom discussion, problem solving, oral presentations and written assignments.

Homework: Three types of homework will be assigned in this course. 1) 5 Problem Sets 2) 2 Reading Reviews and 3) 10 Thought Assignments. Problem sets require mathematical calculations and will be submitted in class. Reading Reviews are typically 2-3 pages and Thought Assignments are 1-2 paragraphs and will be submitted online. Reading Reviews and Thought Assignments will facilitate discussion in class. Additional information will be provided online.

Homework will be submitted individually. Homework that is copied from another student is in violation the university's Code of Academic Integrity. Similarly, students are not allowed to use solutions from previous students. Homework is due at the beginning of the class. Please refer to the schedule for submission dates. **No late homework is accepted**. Missing assignments will receive a zero grade. However, a) there are six problem sets assigned, the lowest grade on the problem set will be dropped. b) For reading Reviews, the lowest grade of the reading reviews will be dropped and c) for Thought Assignments, the lowest grade on a thought assignment will be dropped.

Exams: There will be one midterm exam (October 21st) and a take-home final exam (TBD). The exams are considered Major Grading Events. The Final will be comprehensive. All exams are take home-exams and are due by 4 pm in the ChBE 2113 Mailbox of the professor on the specified date. The Exams will be posted online by 4 pm on the previous week. Students are NOT allowed to collaborate and must work on the exam individually.

Final Project: A final project is required in this course. Additional information about this final project will be provided in a subsequent handout. Undergraduates enrolled in the course may work in groups of 3 or 4 and are expected to present results of their projects as a 10-12 minute video/audio podcast/public service announcement (PSA). Graduate students may work individually on a topic and will present work in the form of an Audio/Visual and Final term paper. Audio/video formats will be 10 minutes maximum. Poster session and judging will take place at the end of the semester *(see tentative schedule)*

Grading:

	ChBE (472)	ENCH 648C
Participation/Professionalism	5.00 %	5.00%
Problem Sets (5 of 6 / lowest grade dropped)	15.00 %	10.00%
2 Reading Reviews (lowest grade dropped)	10.00 %	5.00%
10 Thought Assignments (lowest grade dropped)	10.00%	5.00%
Mid-Term Exam	20.00%	15.00%
Final Presentation (Average of Poster and A/V)	20.00%	20.00%
Final Exam	20.00%	20.00%
Final Paper		20.00%

Students who average less than 60% comprehension of the material will fail this course.
Students who receive greater than 95.00% will receive an A. All other grades will be curved.

Attendance/Participation/Professionalism/: Students are required to attend class. Attendance is directly correlated with class participation and professionalism. The use of social media during lectures is prohibited and will negatively impact your participation grade. You are permitted and encouraged to use calculators, computers, and tablets. An important part of this course is class discussion and activities. The reading and thought assignments will aid in the discussion during lecture. Your professionalism and class discussion grade will depend on your contributions and levels of engagement during the semester.

Basic Rules:

1. You are required to attend class.

2. Homework is due by *the beginning* of class (1:00pm). Submit Online. Late assignments are not accepted.

3. All exams are take-home exams and are due by 4pm.

4. All work must be *original*. Students are encouraged to collaborate. Honesty is the best policy.

5. Any conflict regarding an assignment grade must be resolved within *1 week* after the document has been returned.

6. An exam extension must be requested 48 hours in advance. Significant documentation (e.g. doctor's note) and reasoning is also required.

7. Be Courteous.

Accommodations for students with disabilities: To receive accommodations, students with learning disabilities must provide a written request and documents from the University of Maryland Disability Support Services (http://counseling.umd.edu/DSS). Please submit all requests by September 6th, 2019.

Religious observation: If you will miss class, an exam or due dates, because of a religious observation that is not officially recognized by the university, you must contact the instructor at least 2 weeks before your anticipated absence to discuss alternative dates for assignment.