Course Description
This is the 2nd course of a two-semester series introducing atmospheric chemistry and physics. For this particular course, we will cover topics related to the chemistry and physics of atmospheric aerosols—solid particles and liquid droplets suspended in the air. The course is designed to provide a foundation in atmospheric aerosols suitable for advanced study in atmospheric, environmental sciences, chemical engineering, and professional employment.

Textbook

Meeting Times
As noted above, this class will be taught as Live-Online. We will meet Tu/Th at 8-9:15am via Zoom. Our synchronous meetings will give us the opportunity to meet our course goals, objectives, and learning outcomes in the live online meetings.

Goals & Objectives
My intent as an instructor is to convey fundamental concepts of atmospheric aerosols such that students will:

a) gain an understanding of basic principles of aerosol dynamics, physics, and chemistry
b) prepare you for more advanced fields in atmospheric chemistry and help you in your own research
c) grasp the role of aerosols in our environment

d) explain some techniques on how aerosols are measured;
e) explain the impact of aerosols to public health, regional haze, and climate.

Learning Outcomes
By the end of this course, ATMO/CHEE/ENVS students will be able to:

a) derive and solve the following formulations related to: size distribution, dynamics/transport, mass transfer, coagulation, nucleation, condensation and diffusion;

b) identify sources and sinks of aerosols;

c) describe aerosol dynamical, physical, chemical, and optical properties;

d) explain some techniques on how aerosols are measured;

e) explain the impact of aerosols to public health, regional haze, and climate.

Useful Websites
registrar.arizona.edu
deanofstudents.arizona.edu
Syllabus

Department Website
www.has.arizona.edu

D2L Website
d2l.arizona.edu

Zoom Meeting IDs
81856080861 (Lectures)
81950014977 (Office Hours)

Instructor Website
arellano.faculty.arizona.edu

Dates and Deadlines

Last Day of Dropping:
Jan 26 (U)/Feb 9 (G), 2021

Project Deadlines:
Project Report
(May 13, 2021 5:00pm)

Assignment Deadlines:
Jan 28, Feb 9, Feb 18, Mar 2, Mar 18, Apr 1, Apr 27

Exams:
MidTerm 1: Feb 23/Mar 2 Due
MidTerm 2: Apr 1/Apr 6 Due
Final Exam: May 13 8-10am

Reading Days:
Feb 25 & Mar 9, 2021

Last Day of Classes:
May 05, 2021

Useful Websites
registrar.arizona.edu
deanofstudents.arizona.edu

ATMO/CHEE/ENVS 469B/569B Sect 001 Sp Semester 2021

Air Pollution II: Aerosols

On top of the outcomes listed previously, 569B students will also be able to:

a) apply these concepts to existing aerosol science problem (or to their own research)
b) present related application in a clear, understandable, and efficient manner.

This class is scheduled to be taught in the LIVE ONLINE modality. The students are encouraged to engage themselves (before, during and after lectures). At the end of the course, students are expected to become knowledgeable about the following: aerosol sources and sinks; basic aerosol properties; single particle aerosol mechanics; aerosol population dynamics; optical effects of atmospheric aerosols; aerosols and climate; aerosols and health; regional haze; aerosol measurement techniques; current events and public policy relevant to aerosol particles.

A prerequisite for this class is sufficient math background to know how to handle a first order linear ODE

Course Assessment

Students will be assessed on how they are able to grasp the key concepts, mainly through assignments and exams. The percentage distribution of your grade will be as follows:

Assignments : 40% (U), 40% (G)
Midterm Exam : 2x20% (U), 2x15% (G)
Final Exam : 20% (U), 15% (G)
Project : Optional* (U), 15%(G)
*to replace lowest exam score

Letter grades are determined using the following scale:

A : ≥ 90.0 %
B : 80 to 89.9 %
C : 65.0 to 79.9 %
D : 55.0 to 64.9 %
E : below 55.0 %

A large part of your grade will be through ~7 - 8 assignments + class exercises, 2 midterm exams and 1 final exam. Assignments can be in the form of derivation, computer exercises, problem solving or science article review/discussion. Assignments are typically given after a major section has been discussed (i.e., ~weekly). See Course Outline section for details.

While assignments are best done individually, you can certainly discuss (and to an extent I do encourage you to discuss) your methods and the results with other students in the class. Students can sometimes learn more by discussing the ideas and methods with others than they can on their own. Given that you have different backgrounds/perspectives, the views of others can often be beneficial to a larger group. However, do NOT copy your solutions from anyone else (for programs, each student should write his/her own code) or from any other source such as solution manuals that often have typographical errors. Please cite/acknowledge appropriately if your ideas/methods are not your own.

Homework is due at the beginning of class on the scheduled due date (see D2L). I will accept late assignments with full credit as long as the solutions have not been distributed in class. However, any assignments received after the solutions are distributed will not be accepted for credit. Note: A one letter grade drop will be applied for the first violation of the Code of Academic Integrity (including using a solution manual or other service to assist you with homework) in addition to receiving a zero for that assignment.

For 569b students, projects will be in the form of either of the following: a) numerical aerosol modeling exercises, b) aerosol data analysis, or c) critical review of a research article related to aerosols, or term paper of a particle topic – e.g., geoengineering/covid-19 transmission.

Exams will be all take-home exams but with 75-minute limit and closed books/notes.
Air Pollution II: Aerosols

Attendance
The UA’s policy concerning Class Attendance, Participation, and Administrative Drops is available at: http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop

The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable. See: https://policy.arizona.edu/human-resources/religious-accommodation-policy

Absences pre-approved by the UA Dean of Students (or Dean Designee) will be honored. See: https://deanofstudents.arizona.edu/absences

If you feel sick or may have been in contact with someone who is infectious, stay home. Except for seeking medical care, avoid contact with others and do not travel.

Notify me if you will be missing our online course. Campus Health is testing for COVID-19. Please call (520) 621-9202 before you visit in person. Visit the UArizona COVID-19 page for regular updates.

Classroom Behavior
To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand and not on extraneous activities (e.g., texting, chatting, reading a newspaper, making phone calls, web surfing, etc.).

The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students.

Life, Physical, & Mental-health Challenges
If you anticipate or are experiencing unexpected barriers related to the format or requirements of this course, please meet with me so that we can discuss ways to ensure your full participation in the course. Please note the Dean of Students Office is a central support resource for all students and may be helpful. The Dean of Students Office can be reached at 520-621-2057 or DOS-deanofstudents@email.arizona.edu.

If you are facing physical or mental health challenges this semester, please note that Campus Health provides quality medical and mental health care. For medical appointments, call (520-621-9202. For After Hours care, call (520) 570-7898. For the Counseling & Psych Services (CAPS) 24/7 hotline, call (520) 621-3334.

If you determine that disability-related accommodations are necessary, please register with Disability Resources (621-3268; drc.arizona.edu) and notify me of your eligibility for reasonable accommodations. We can then plan how best to coordinate your accommodations.

Academic Integrity
Note that associated with your learning experience are sets of ‘rules’ to diligently follow. From the University perspective, you are expected to adhere to the University’s “Code of Academic Integrity” and “Student Code of Conduct”. You are responsible for knowing these codes (and revisions).

Academic Advising
If you have questions about your academic progress this semester, or your chosen degree program, please note that advisors at the Advising Resource Center can guide you toward university resources to help you succeed.
Nondiscrimination & Anti-Harassment
The University is committed to creating and maintaining an environment free of discrimination; see http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy

Student Responsibilities
To learn this course, you are expected to be involved all throughout. As a student, you are responsible in a) actively asking and answering questions during class, b) doing your assignments (including reading materials) after class, and c) responding to d2l class announcements/surveys. Doing so will greatly enhance your learning experience. As your instructor, I invite you to make use of our office hours if you have some pressing questions.

From the University perspective, you are expected to devote a minimum of two (2) hours outside class (for study, reading, homework) for every contact hour (or 50 minutes) in classroom.

Equipment and Software
For this class you will need daily access to the following hardware: [laptop or web-enabled device with webcam and microphone]; regular access to reliable internet signal; ability to download and run the following software: [Matlab/R/Python, spreadsheet, e.g., MS Excel, web browser to access D2L, PDF reader, text editor -e.g., Microsoft Word, slide presentation -e.g., Powerpoint, Zoom client, VPN for possible access to a HAS server].

Class Recordings
For lecture recordings, which are used at the discretion of the instructor, students must access content in D2L only. Students may not modify content or re-use content for any purpose other than personal educational reasons. All recordings are subject to government and university regulations. Therefore, students accessing unauthorized recordings or using them in a manner inconsistent with UAztarina values and educational policies are subject to suspension or civil action.

Reference Materials


Final Note
Some information in this syllabus may be subject to change with advance notice as deemed appropriate by the instructor. Your comments are welcome and appreciated.
Course Outline

Below is our tentative schedule. We may extend/shorten the lecture/discussion of some sections (e.g. special topics) depending on the average progress of the class.

Course Syllabus/Introduction
Jan 14
Introduction to Aerosols
Relevance (Ch 1)
Jan 19
Gases (Ch 2)
Jan 21
Sources and Sinks/Composition (Ch 14)
Jan 26
Particle Size Distribution (Ch 4)
Jan 28, Feb 2
Aerosol Dynamics
Uniform Particle Motion (Ch 3)
Feb 4-9
Curvilinear Motion (Ch 5)
Feb 9-11
Adhesion, Brownian Motion, Diffusion (Ch 7)
Feb 16-18

Mid-Term 1 Exam
Feb 23 (Review)

Aerosol Physics
Thermal, Radiometric, Electrical Forces (Ch 8/15)
Mar 2
Mass Transfer (Ch 13)
Mar 4, Mar 11-16

Coagulation (Ch 12)
Mar 18-23

Nucleation (Ch 13)
Mar 23-30

Mid-Term 2 Exam
Apr 1 (Review)

Aerosol Impacts and Control
Cloud Microphysics (Ch 13)
Apr 6-9
Filtration, Inlets, Sampling (Ch 9/10)
Apr 15
Health Effects (Ch 11)
Apr 20-22
Optics (Ch 16)
Apr 22-27
Geoengineering
Apr 29

Review
May 1

Final Exam
May 13 8am-10am

Project Report Due
No later than May 13, 2021 5pm